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WILD LIFE
OF THE WORLD

LION AND LIONESS.

WILD LIFE OF THE WORLD

A DESCRIPTIVE SURVEY OF THE GEOGRAPHICAL DISTRIBUTION OF ANIMALS

BY

R. LYDEKKER, F.R.S.

ILLUSTRATED WITH
OVER SIX HUNDRED ENGRAVINGS FROM ORIGINAL DRAWINGS
AND
ONE HUNDRED AND TWENTY STUDIES IN COLOUR

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AFRICA

SACRED IBIS.

CHAPTER I

General Remarks on Africa and its Fauna

To the naturalist, and more especially to the palæontologist, Africa is one of the most interesting continents of the world, not only on account of the peculiarity of the fauna of its central and southern portion, but from the fact that it has existed as land from a very remote geological epoch, namely, from the one known as the Permian, which immediately succeeded the Carboniferous or Coal period of Europe.

From the Permian and overlying Triassic formations of southern Africa have been obtained the remains of an extensive group of extinct reptiles, which are of exceptional interest on account of the fact that they include types which pass almost imperceptibly into the primitive salamanders, and others which appear undoubtedly to represent the ancestral stock from which mammals have originated.

At the period when these mammal-like, or anomodont, reptiles flourished Africa appears to have been connected with India by way of Madagascar and the Comoro and Seychelle Islands; and it is almost certain that somewhere in this vast continent the passage from reptiles to mammals took place; the probability being that the evolution took place in its southern portion—that is to say, in central or southern. This event is, perhaps, the most important of those connected with the life-history of the world which ever took place, for it was the commencement of the chain of evolution which culminated, under Divine guidance, in the evolution of man himself.

For many years little or nothing was known with regard to the past history of mammalian life in Africa, and it became an axiom among naturalists that for countless ages preceding the modern period the whole of this continent lying to the southward of the Sahara was devoid of mammals, and that it received the ancestors of its existing fauna from the countries to the north.

Although this appears to have been really the case with regard to a considerable portion of the mammalian fauna, it does not hold good for the groups now represented by the elephants and the hyraxes, of which the ancestral types have been discovered in the lower Tertiary or Eocene formations of the Fayum district of Egypt—formations which are incalculably later in time than those containing the remains of the aforesaid mammal-like reptiles. It is, moreover, highly probable that the man-like apes are also an African product, seeing that their earliest known representative flourished at the same time and in the same area as the ancient Egyptian forerunners of the elephants.

Another feature of special interest in respect to the past history and evolution of Africa is the geological and palæontological evidence pointing to the existence of a former land connection between that continent and South America on the one hand and Australia on the other; these connections being the last remnants of the earlier and much more extensive land-area which has been named (from the Gond tribes of India) Gondwanaland. This great land-area appears to have been gradually broken at various epochs, and its remnants are now respectively represented by Australia, India, Africa, and Brazil. The separation of Brazil seems to have been the final stage in the dismemberment of this ancient continent; but the geological epoch in which the severance occurred cannot yet be definitely fixed. Some naturalists believe that it took place at the close of the Mesozoic, or Secondary, epoch, which immediately preceded the Tertiary, but others, especially Americans, believe that it persisted into the latter epoch.

At one time it was considered that the occurrence of an extinct genus of insectivorous mammals (*Necrolestes*) in the middle Tertiary Santa Cruz formation of Patagonia, closely related to the golden moles (*Chrysochloris*) of southern and eastern Africa, implied a very late connection between South America and Africa, but the subsequent discovery in North America of extinct genera allied to the golden moles rendered this evidence of little or no importance. On the other hand, the belief that certain extinct flesh-eating mammals from the Santa Cruz beds, typified by the genus *Prothylacynus*, are true marsupials, near akin to the modern Tasmanian wolf (*Thylacynus*), is of great importance as indicating a late land communication between South America and Australia. Further evidence in the same direction is afforded by the occurrence in the late Tertiary deposits of Patagonia and Queensland—and nowhere else in the world—of gigantic horned land tortoises (*Miolania*) of an altogether peculiar and isolated type.

Turning to another point, it is mentioned in the next chapter that the fauna of Africa is of an entirely different type from that of the central and southern parts of the continent; and it is not a little remarkable that this division of Africa into two great and distinct faunistic areas is very closely paralleled by the distribution of the various types of the human race in that continent.

Northern and part of East Africa is, for instance, populated by tribes, such as the Berbers, the members of the Semitic group, as represented by Jews, Arabs, and Abyssinians, and the various types of the Hamitic group, inclusive of the Fellahin and Copts of Egypt, the Gallas of southern Abyssinia, the Somalis, the Bisharin and Hadendoa Arabs of the eastern Sudan, and the Bahima of Uganda, all of which are related to the Caucasian or white races of Europe and western Asia.

On the other hand, the greater portion of what is conveniently termed Ethiopian Africa, or that portion of the continent situated to the south of the Sahara and Libyan Deserts, is the main home of the Negro stock, which constitutes the lowest branch of the human race. The Negro, or Ethiopian, races, it may be noted, are characterised by their dark, often nearly black, complexion and black hair, typically of the kind called "frizzly"; that is to say, a type in which each hair is closely rolled upon itself, and has an elliptical or flattened section. The beard is of scanty or moderate development, the skull is almost invariably of the long type, the cheek-bones are small and moderately retreating, the nose is broad and flat, with a low bridge, the eyes are prominent, the lips thick and everted, and the teeth relatively large. African Negroes are divisible into two main sections—the typical Negroes, who inhabit that portion of the continent north of a line extending from the Rio del Rey to the Albert Nyanza, and thence with a southerly trend to the coast, and the Bantu, as represented by Kafirs, to the southward of the same. The members of the first group present great similarity of physical type, and are chiefly distinguished by language; the converse being the case with the Bantu. The pigmies of Central Africa, scientifically known as Negrillos, are a dwarf race in which the hair is of the most frizzly type, and the complexion lighter than that of most Negroes; but the projecting jaws, wide nose, and protruding lips exhibit an ultra development of the Negro type, and thus show a low grade of organisation. Except as regards bodily size, their only essential difference from true Negroes is the tendency to a shortening and broadening of the skull. The South African Bushmen, now almost exterminated as a pure type, constitute a modification of the Negro stock in which the hair exhibits the extreme development of the frizzly type. It is, for instance, shorter and more sparse than in typical Negroes, and presents the appearance of growing in separate tufts which coil up into balls, and is hence known as the "pepper-corn" type. The beard is scanty, and little hair is developed on any part of the body except the scalp; while the skin is of a dirty yellow colour very like that of leather.

THE BEATRIX ORYX.

CHAPTER II

THE ANIMALS OF NORTHERN AFRICA

IT might well be supposed that the whole of the great southern continent of the Old World would possess an assemblage of animals different from those of Europe and Asia; but, as a matter of fact, this is true only for that portion of Africa lying to the southward of the Sahara Desert, which has formed for ages an impenetrable barrier between the fauna of the northern districts and that of the vast tracts of country to the southward. The North African fauna is, indeed, practically a part of that of southern Europe and western and north-western Asia; and naturalists recognise a Mediterranean province, or transitional region, which comprises the countries on both sides of the Mediterranean, and extends eastwards to the north-western borders of the Punjab and Kashmir. The essential difference of this fauna from that of central and southern Africa will be apparent when we come to the consideration of the latter in a subsequent chapter.

The southern limit of the North African fauna is approximately marked by the twentieth parallel of N. latitude on the western side of the continent. On the eastern side the valley of the Nile has, however, rendered it possible for freer communication to take place between the northern animals and those of the central and southern area; and here consequently we find the distinction between the northern fauna and that of the rest of the continent much less sharply defined. It is, in fact, impossible to draw on this side a hard and fast line between the two faunas. For this reason it has been convenient to include in the present chapter certain species inhabiting the Nile valley which were as important to the ancient inhabitants of that tract as they are to their present-day successors. It must be added that since the North African fauna agrees in the main with that of the rest of the Mediterranean province, the animals selected for notice will, to a great extent, be those chiefly or exclusively characteristic of the African portion of that area.

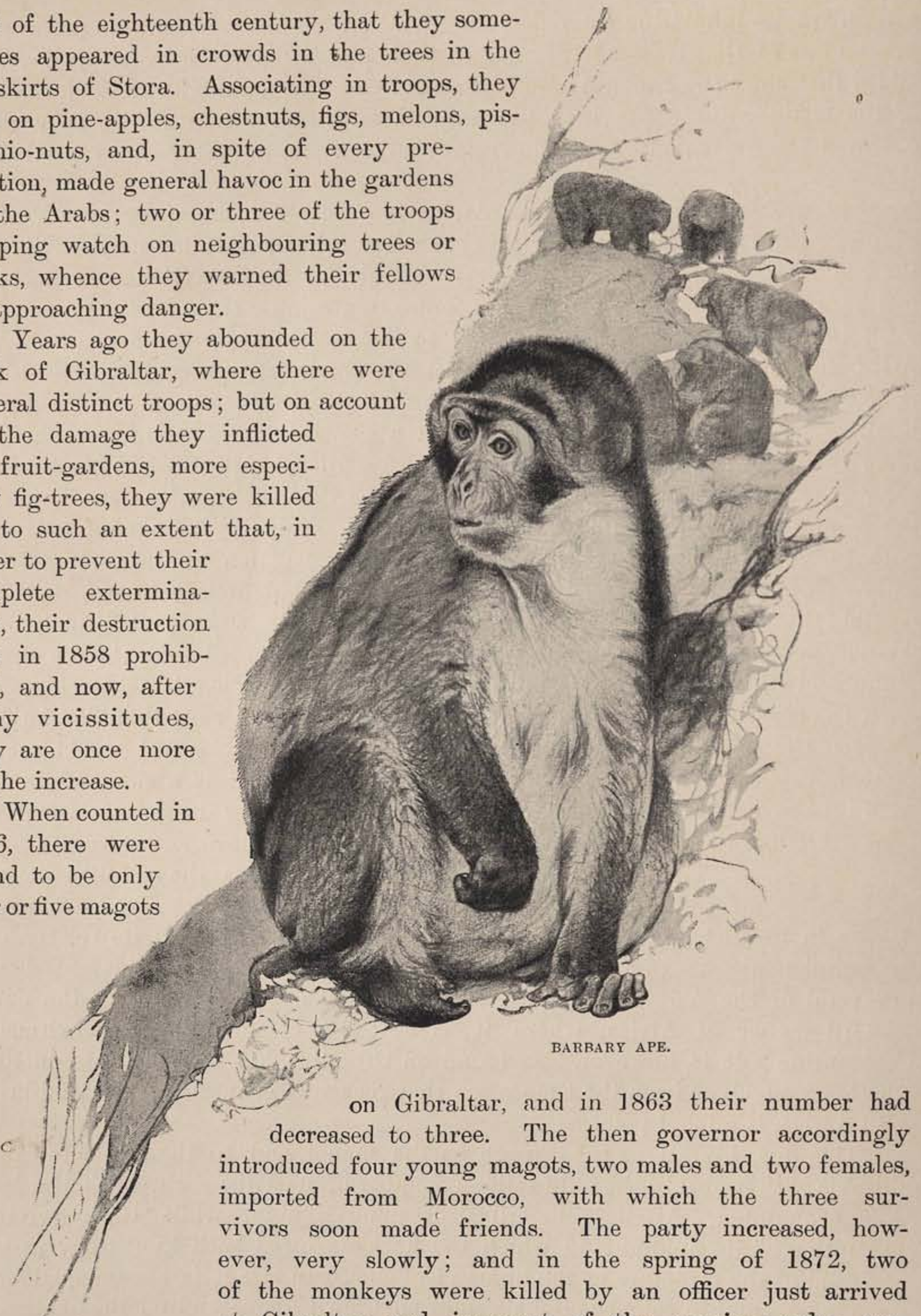
The greater part of northern Africa is chiefly a mountainous and plateau country; the main exceptions to this character being the valley of the Nile and the coast plains of Tripoli and Algeria. Much of the area is, indeed, more or less bare and desert-like; the desert conditions attaining their maximum development in the Sahara, which commences to the southward of the chain of the Atlas, and extends to the 15th parallel of north latitude, with a breadth in some parts of more than a thousand miles. This great sterile area, interspersed locally with oases, forms a plateau with a general elevation of probably not more than between 1000 and 1500 feet above sea-level. Its present barren character may not improbably be attributed to the destruction of primeval forests, the former existence of which is attested by the silicified trunks of trees met with in various localities. What caused the destruction at the comparatively early epoch when these fossil trees flourished is not definitely known, but it is possible that wild camels, remains of which occur in the superficial formations of Algeria, may have been the chief agents. It may be noted that the sea around Malta and Sicily is comparatively shallow, and that another bank stretches out from the coast of Tripoli, leaving a narrow channel of not more than 250 fathoms between the two shallow areas. An elevation of some 1500 feet would accordingly have been sufficient to unite Africa with Italy, while a similar elevation would have connected Morocco and Spain, thus leaving in former times two immense lakes to represent what is now the Mediterranean.

Barbary Ape.

The only true North African monkey is the so-called Barbary ape (*Macacus inuus*), which belongs to a genus otherwise exclusively Asiatic in its distribution; this particular species differing from its relatives by the complete absence of a tail,—an appendage which attains a considerable length in several of the Asiatic macaques. The Barbary ape is a native of the north-western corner of Africa, where it is specially common in the environs of Constantine. It is, however, also found on Gibraltar, but whether introduced, or whether a survivor from the time when that rock was connected by a land-bridge with Africa, is a moot point.

This ape, known to the French as the magot, and to the ancients as the pithecus, was probably the only tailless member of its tribe with which the latter were acquainted. Aristotle described it unmistakably, while Galen wrote a description of its anatomy to which the ancients owed such knowledge as they possessed of the structure of the human skeleton. In size it is about equal to an average dog, and in colour is light yellowish brown above and on the outer sides of the limbs. The head and a stripe on the cheeks are somewhat darker, while the under-parts are dull yellowish white, and the bare callosities flesh-coloured. A small fold of skin, unconnected with the backbone, is the sole vestige of the tail.

So common were these apes in the forests of the Atlas near the sea at the end of the eighteenth century, that they sometimes appeared in crowds in the trees in the outskirts of Stora. Associating in troops, they fed on pine-apples, chestnuts, figs, melons, pistachio-nuts, and, in spite of every precaution, made general havoc in the gardens of the Arabs; two or three of the troops keeping watch on neighbouring trees or rocks, whence they warned their fellows of approaching danger.



BARBARY APE.

Years ago they abounded on the rock of Gibraltar, where there were several distinct troops; but on account of the damage they inflicted on fruit-gardens, more especially fig-trees, they were killed off to such an extent that, in order to prevent their complete extermination, their destruction was in 1858 prohibited, and now, after many vicissitudes, they are once more on the increase.

When counted in 1856, there were found to be only four or five magots on Gibraltar, and in 1863 their number had decreased to three. The then governor accordingly introduced four young magots, two males and two females, imported from Morocco, with which the three survivors soon made friends. The party increased, however, very slowly; and in the spring of 1872, two of the monkeys were killed by an officer just arrived at Gibraltar, and ignorant of the garrison-order protecting the magots. These were soon replaced by two or three others from Morocco; but the latter were killed by the Gibraltar monkeys and one full-grown male fell a victim to a fire which raged on the rock in June 1874. At that time several young magots were born, so that by the spring of 1875 the troop consisted of six adult females, two large males, and a number of young. Although one of the males looked in poor condition and seemed to be very old, the other was exceedingly vigorous, and took the leadership of the troop. He kept order by biting or running after obstinate members of the party, and headed the gang when changing their residence. The loss of this male, which was missed on the 17th of August 1875 and found dead in the beginning of September of the same year, seems to have hindered the increase of the troop, for between 1875 and the end of 1877 no young were born. Towards the end of that year the troop consisted of four adult and as many younger females, and of four medium-sized members of the same sex, together with one male of about the same size, and five younger males about three years old; but since the death of the old monkey, the troop did not keep so well together and its members quarrelled a great deal among themselves. In 1880 they were flourishing once more, for in the preceding spring there had been born four young, two of which, strangely enough, had short tails; and in 1893 the number had increased to thirty.

The Gibraltar magots are fond of the steep slope of the rock facing the Mediterranean and inaccessible to man; but they are very sensitive to the cold damp east wind which blows against that side from time to time, and therefore move to the western slope, looking towards the town, whenever the wind blows from the east. Their favourite abode is a spot situated above the Alameda garden at the foot of Charles v.'s wall, about half-way up the western side of the rock, which is covered with bushes, and called the monkeys' garden. Another shelter to which they retire four or five hours before a change of wind sets in is the monkey-cavern, close to the sea. The monkeys in the course of time grew so intimate with their protector, the signalman, that they ventured within the fence of the signal-station, especially during droughts in summer, in order to get water. The signalman never saw them eat any of the food put out for them, except grapes, which they seemed to appreciate; but they greedily ate grass, as well as all kinds of roots and bulbs, such as those of the yellow Cape sorrel, along with the fruits of the palmetto, which are equally appreciated by the Gibraltar street-boys, who call them monkeys' dates. Sometimes fights take place among the monkeys; one of the offenders being chased down steep ridges, stumbling and rolling every now and then, but, if necessary, grasping twigs of bushes, or clutching projecting corners of rocks, and thus covering several hundred feet in a few moments. On one occasion, when a large male monkey was caught in an ammunition-box, to which it had been enticed by fruits, it could not be overpowered until three artillerymen threw themselves upon it with their cloaks. After it had been chained up and become reconciled to confinement, it used to scrutinise the whereabouts of its former companions from a place overlooking the eastern slope of the rock. This, however, was a sign, not of longing for, but of fearing its fellows, as it showed the strongest symptoms of terror every time they approached. On another occasion two females were observed sitting beside each other, chattering, and comparing their young: they were soon after joined by a male, which took its place between them, and joined in the conversation for some minutes. This male used almost continually to carry about one or two of the young ones during the summer. In captivity these apes are fond of taking care of smaller animals, even those belonging to quite different groups, and will carry them about, caress them with evident satisfaction, and defend them furiously in case of any attempt to take them away. They are also very sociable, and make friends with any larger animals kept in the same cages. When young they are lively, active, clever, and good-natured, but with increasing age they grow surly and often positively vicious.

Musk-Shrew. Among the insect-eating mammals, the pigmy Egyptian musk-shrew (*Crocidura religiosa*) is noteworthy as being one of the smallest of non-flying mammals; it is considerably smaller than the European pigmy shrew-mouse, being only 1½ inches long, exclusive of the tail, which is just under an inch in length. Possibly, however, a Malagasy species is still smaller. There are two much larger kinds of musk-shrews inhabiting Egypt, namely *C. olivieri* and *C.* (*Pachyura*) *crassicaudata*. The bodies of all three were carefully embalmed by the ancient Egyptians. A pigmy species (*C.* [*P.*] *etrusca*) also occurs in Algeria, Arabia, and southern Europe, where it inhabits the south of France, Italy, Sicily, Trieste, and the Crimea. It differs from the Egyptian species in the number of its teeth.

Hedgehogs. Hedgehogs are represented in north-western Africa by *Erinaceus algirus*, a near ally of the ordinary European species. Egypt is, however, the home of a second and smaller kind, the long-eared hedgehog, *E. auritus*, which is also found in Cyprus, and on the Continent to the north extends from the Caucasus and Asia Minor into central Asia. In addition to its diminutive size and large ears, it is characterised by the absence of a bare patch on the forehead, and the longitudinal grooving of the spines, which also carry minute tubercles. The southward range of this species extends towards Nubia, but on the upper Nile it is replaced by the larger *E. æthiopicus*.

Jumping-Shrews. Of greater interest is the exclusively African family of jumping-shrews, *Macroscelididæ*, represented in Algeria by *Macroscelides rozeti*. Some of these animals are of the size of a rat, but all progress by hopping on their hind-legs after the manner of miniature kangaroos; and to adapt them for this kind of movement the basal bones of the hind-feet are unusually elongated. They are also characterised by the great length of the muzzle, which forms a kind of trunk, whence the name *rat-à-trompe*, applied to the Algerian species by the French.

The following account of the habits of a captive specimen of one of these elephant-shrews, as the jumping-shrews are often called, is given by Major G. B. H. Barrett-Hamilton: "Its most curious feature was its proboscis, which was never still for a moment, but seemed to be constantly affected with a kind of St. Vitus's dance, twitching now to this side, now to that, now up, now down. When the end of the proboscis, during its twitchings, came over an ant, its motions would change slightly, and it would quiver over the ant as if aware of its presence. Then suddenly out would dart a long, thick tongue, the ant vanished as if by magic, and its fate was indicated only by the working of the little jaws of the shrew Except for the very much lesser use of the eyes, the performance put me in mind of the feeding of a toad. Nearly all its food was taken by the use of the proboscis, but occasionally by using its eyes. When hungry the proboscis was often put right into the holes of lumps broken off ant-hills placed in the box, and the ants were then taken out with the tongue. From this habit and its enormous eyes, I believe that the elephant-shrew must be largely nocturnal in its feeding. But it may certainly be observed in sunny places in the daytime, either sitting quietly in the sun, or moving suddenly and with extraordinary rapidity. I have seen it on rocks and in ruined houses, where it is evidently common, and with the colour of which its back harmonises well. In fact, on 'No. 2' kopje on a sunny afternoon I could always be sure of observing two or three at the same time. The individual I kept alive showed no resistance or temper. It made no attempt to bite, and if much frightened lay quite flat for some minutes on the floor of its box, shivering all over, its ears flattened back, and its large, conspicuous eyes shut. At such times it occasionally 'drums,' like a rabbit, with one of its hind-feet."

Lion. Although common to the whole of Africa, as well as to a considerable portion of south-western Asia, such an important animal as the lion (*Felis leo*) cannot be passed over without notice in this place. This animal is too well known to need description, and it will suffice to mention that the male is distinguished from all other members of the cat tribe by the profuse mane clothing the head and fore-quarters. Young lions are marked with dark streaks and spots, and such markings persist for a long period, if not permanently, in the East African representative of the species. The lion is thus evidently descended from a spotted or striped animal.

Although in South Africa both black-maned and tawny-maned lions may apparently occur in the same litter, yet there are certain local differences in regard not only to the length, thickness, extent, and colour of the mane, accompanied by differences in the general colour of the coat and by certain other peculiarities, on the strength of which the lion has been divided into a number of races, or subspecies. Among these, the North African lion (*F. leo barbara*) is specially characterised by its large bodily size, dusky ochery colour, and the long and profuse mane, which extends as far as the middle of the back, and is also developed on the under surface of the body. In the lioness of this race the inner side of the fore-legs is white.

In addition to the mane, the tuft at the end of the tail is a feature common to the males of all lions. In this tuft there occurs frequently, although not apparently invariably, a small horny spur, the function of which still remains unknown.

The lion readily adapts itself to the conditions of its natural surroundings, which are by no means always the same; its haunts in many parts of Africa being dry open plains, while in the valleys of the Euphrates and Tigris dense reed-bushes are the favoured places. In former times the Indian race (*F. l. gujratensis*) was once common on the sandy plains of Rajputana, but it is now restricted to the Gir forest of Kathiawar. The Mesopotamian race (*F. l. asiatica*) still inhabits the swampy lowlands of the Euphrates and Tigris. In Africa lions formerly abounded in the Kalahari desert, and till quite recently, at any rate, were just as common in the uplands of Mashonaland, in the rugged districts watered by the tributaries of the Zambesi, in the thorny scrub westward of the Gwai River, and in the marshes of the Linyanti. The number and ferocity of the lions encountered during the construction of the Uganda railway have become historical.

In all such diverse stations lions lead a nocturnal life, and are but seldom seen by day, when they take their rest, either in high grass or among thickets and bushes. At sunset they start on the prowl, when they make themselves heard to a greater or less degree according to the state of the weather. It is during dark and stormy nights that they are most daring and venturesome; and they are much more deliberate and cautious in moonlight, especially when visiting their drinking-places. Under all circumstances they are, however, in the habit of roaring loudly and repeatedly, in which respect they differ markedly from all the other members of the cat tribe, which are comparatively silent animals.

NORTH AFRICAN LION.

Some travellers state the lion's roar is terrifying only if heard amid pouring rain which extinguishes the camp-fire, on a dark, stormy night, lit up by dazzling lightning, with no chance of mounting a tree; and that no one sitting comfortably in a house, or beneath the tented roof of an ox-cart, would ever be startled by such a roar. It has, moreover, been definitely asserted that a European is able to distinguish the lion's roar from the call of a male ostrich solely because the one is heard at night and the other by day. Other sportsmen and travellers ridicule the idea of any comparison between the roar of the lion and that of the ostrich; asserting that while from a distance the roaring of a solitary lion has no doubt a great resemblance to the pairing-call of the ostrich, yet to compare the roar of a lion close by to the call of an ostrich would be like comparing the rattling of a carriage across a bridge to the rolling of thunder in the mountains. When lions are roaring together at a short distance in concert the combined noise has been asserted to surpass every other sound in grandeur. One traveller states, for instance, that nothing in the way of power and profuseness of sound is to be compared to the roaring of a lion, which literally shakes the earth, and that nothing sounded so grand to his ears as a lion's roar in the otherwise completely undisturbed silence of an African desert night. Another traveller describes the power and grandeur of the lion's roar as reaching its zenith when two or three troops of challengers approach a drinking-place, and each challenges the other troops by its roars. Nowadays every European can find at least an occasional opportunity of forming his own opinion on the lion's roar, as these animals are kept in every zoological garden and every menagerie, when in the evening after they have been fed, as well as during the night, they raise their voices if anything too frequently. As regards the nature of the roar, one writer describes it as consisting of a five-or-six-times-repeated dull deep, plaintive sound ending in a weak sigh, which is only audible in the immediate neighbourhood of the animal. At other times he compares it to a sequence of deep, but loud, solemn rolling sounds, gradually increasing in strength until the third or fourth repetition, which at last die away in a murmuring growl resembling far-off thunder. The trembling ground, writes another observer, seems to pour forth the deep powerful roar of the lion; and this comparison is certainly not unfounded, for lions roar with their heads bent to the ground, thereby greatly strengthening the effect and reverberation of their voices. One lion, watched by a well-known traveller, used to repeat his roar for hours in this fashion.

A thoroughly experienced observer, much as he may admire it, cannot be startled by the grandeur of the lion's roar, as it does not indicate either hunger or thirst for blood. Lions, indeed, often roar when they are satisfied; and the loudness of their voice would certainly not assist them in surprising their prey. In isolated and undisturbed parts the roar may be heard on bright, sunny days till nine or ten o'clock in the morning, and in rainy weather, or when the sky is clouded, even all day long, although in a subdued tone. Generally a lion begins to roar in the evening gloom, and continues with shorter or longer intervals through the whole night; a roaring lion, as already mentioned, not being always hungry. The roar of the lion is specially meant for its fellows; but other sounds, audible only when in close proximity, are much more alarming, as, for instance, the uninterrupted growling, when the animal, surprised in its haunts, puts down its ears, waves its tail in an uneasy manner, and, hesitating between flight and attack, examines the situation, and tries to warn off the intruder by its attitude. Neither is the angry grunting of a partially satiated lion, when surprised at its meal and unable to flee, calculated to induce any confidence. Most terrific, however, are the short, coughing sounds of a lion when preparing to attack. Although in some districts lions go about either alone or in pairs, parties of four, five, or even more are far from uncommon in the interior of South Africa, and troops of ten or twelve are not considered rare. Even in large troops each female has been stated to associate with a particular male, and that the union of a lion and lioness generally lasts for life; but the statement has recently been disputed.

Although in Africa the prey of lions comprises antelopes, giraffes, zebras, and buffaloes, one observer has stated that in some districts the latter are the chief objects of pursuit, and on one occasion he saw a whole troop of buffaloes dispersed by lions at night. On the other hand, the same observer believes that buffaloes do not form the favourite food of the South African lion, but that a lion would prefer a rhinoceros to a buffalo, and a zebra to a rhinoceros, since soft juicy fat affords him a dainty feast, and as he is unable to overpower rhinoceroses and hippopotamuses, no other animals would furnish such a large supply of such food as zebras. These animals keep, however, as much as possible to the open plains, and never approach a thicket from which a lion might be able to attack them, thus giving their enemy opportunities only at the drinking-places.

On the other hand, buffaloes appear to be continually in the vicinity of the haunts of lions, although they are dangerous objects of attack. As a matter of fact, buffaloes not unfrequently wound and even kill lions, but nevertheless often form their principal food. Lions are, however, by no means restricted to animals killed by themselves; they are, for instance, partial to the flesh of rhinoceroses, and will gorge themselves from carcases of these animals even when in an advanced stage of decomposition. Again, when the carcases of elephants are left to decay in the rays of the tropical sun till they form a mass of corruption, lions will come and feast on them night after night, till all the flesh is devoured. This happens in districts rich in game, where lions would have little trouble in procuring fresh zebra or antelope meat. Old and infirm lions, no longer able to kill large prey, are perforce content with small animals, and will catch mice and other small rodents, and even graze occasionally, while in the neighbourhood of villages they devote their attention to the goats of the natives, or attack any women and children who may cross their paths at night.

It is not improbable, were they suffered to live long enough, that some lions, when too weak to hunt game, would become, like tigers under similar conditions, regular man-eaters; but owing to the courage of the natives, which far surpasses that of most of the inhabitants of India, this never happens in the greater part of Africa. After two or three of their fellows have fallen victims to a lion, the inhabitants of the district are called together to form a hunting-party, and soon surround and kill the lion with their spears; and even if a lion kill merely an ox or a goat in the land of the warlike Matabili, he is generally doomed. In Zululand, Tongaland, and Swaziland a few man-eating lions were, however, stated to be in existence, and there are stories about one lion, apparently in full strength, or, at any rate, able to leap the high fences surrounding the Zulu villages, which killed between thirty and forty people and almost depopulated the country. Another lion had grown notorious for its frequent attacks on the hunters' encampments, although it inhabited a country rich in game.

Apart from those to which human prey has become habitual, lions, if unprovoked, usually leave man alone. By some writers the lion is described as a bloodthirsty but noble animal, while others, perhaps with more justice, call it cowardly and mean ; at any rate, it generally avoids an encounter when possible. If it acts otherwise, there is usually some special reason; either the sportsman has come upon it unawares, so that it sees no way of escape, and, driven by this fear, ventures on an attack, or it has been half-famished and disturbed by the intruder in the act of devouring its prey, which it has no intention to relinquish. On the other hand, the lioness will invariably defend her young against any real or imaginary danger. When unmolested, lions in some parts of Africa are by no means dreaded by the natives, the Hamran Arabs of the Sudan showing, for instance, no fear of the numerous lions of their country; when much harassed, these animals are, however, looked upon with more respect. It may be added that there are a few cases in which lions have attacked man without previous provocation, this holding good not only for famished, but for exceptionally disposed animals. In an event of this kind reported some few years ago from East Africa three natives were walking along the edge of a lagoon, when suddenly a lion, which had announced its presence by nothing but a low rustling, leapt on the first and threw him on the ground. When the other two, who at first had climbed a tree but soon returned to the pursuit, were going to fire, the lion, with a terrific roar which almost prevented them from running, delivered a frontal attack. Having first caught up one of the pair, it shook him for some seconds, and then turned to the second, who had meanwhile taken advantage of his respite and fled, and by a hair's-breadth escaped the spring of the enraged beast. The latter then returned to its latest victim, who was not yet dead, seized him in its mouth, but soon dropped him again, then threw him like a cat does a mouse to and fro between its paws, and finally killed him by one bite of its jaws. The only survivor of the party had taken refuge in a tree, where he was besieged by the lion for hours, but was eventually able, at the risk of his life, to pick up his gun and shoot the lion dead. A lion-hunter who is able to ascend a tree is always out of danger so long as he remains there, for the lion is one of the few cats incapable of climbing trees. There is not, however, always a tree at hand for the lion-hunter, when, on foot, he finds himself exposed to attack. Lion-hunting is, indeed, by no means free from danger, although not so dangerous that experienced sportsmen, who are acquainted with the habits of lions and shoot straight, should run any very great risk of their lives. Nevertheless, an English sportsman in South Africa who succeeded in killing sixteen lions, declared lion-hunting to be very much more dangerous than any other kind of South African shooting; and although he admitted that more accidents took place in buffalo-shooting, he explained this by the fact that in his time about fifty buffaloes were killed to one lion. He added, however, that the danger of lion-hunting is diminished when dogs are employed, so long as the attention of the lion is diverted by these from the sportsman. Even then, however, the lion will sometimes go straight for the hunter. On the other hand, a mounted man should generally be able to save himself on even ground, as the speed of the lion is not sufficient to overtake a horse.

A lion, although he apparently never leaps, but runs like a dog in an awkward gallop, moves with relatively great speed, and even in his ordinary pace covers, owing to his long strides, a considerable distance in a shorter time than at first appears to be the case. This rapidity of movement and the capacity of the lion for hiding in long grass, in which he is perhaps cleverer than any other animal, make it a dangerous thing for a hunter on foot to pursue a wounded lion, however easy the first attack may have been. Even a wounded lion sometimes springs with lightning-like rapidity on the pursuer; and in any case the death of a hunter approaching a wounded lion is pretty certain, instances in which natives armed only with spears have killed lions before they themselves were badly wounded being exceptions. Generally a whole troop of natives, armed with spears, join in attacking a lion, which sometimes leaps at one bound over the heads of the nearest men right into their midst, rushing from one to the other, striking down a man with each blow of his paws, and at last dying pierced by innumerable spears. Whatever exaggeration may occur in descriptions of the sport, it is at any rate clear that the danger in the case of a solitary lion-hunter on foot is infinitely greater than in tiger-hunting from the back of an elephant.

Lions, like tigers, attack their prey with a cough-like roar. They advance rapidly, with their bodies close to the ground (not erect as so often represented in pictures), and with their ears laid so close down as to make them look almost earless, and on reaching their foes at once strike them to the ground. One well-known traveller has related that the pain experienced as the claws and teeth of the lion pierce the flesh is less than might be expected, and that only the breaking of the bones between the powerful jaws of the beast is really agonising. The same observer states that he experienced nothing of that stupor, which has been said by other travellers attacked by lions to prevent any feeling of pain. He considers it best to keep perfectly quiet under such circumstances, as lions bite at everything that moves. Lions do not apparently dislocate the neck-vertebræ of their victims in the fashion of tigers, as cows and other animals killed by lions have been found with their necks unbroken; and a lioness has been seen clutching a camel for several minutes without making the slightest attempt to break its neck. Other lions have been observed to kill a horse, a small elephant, and two antelopes by biting at the throat, and zebras by biting them close behind the head in the back of the neck. Buffaloes alone are said to be sometimes killed by lions leaping upon their shoulders and smashing their noses with one paw, by which means the necks of the victims are suddenly bent sideways, thus breaking the vertebral column.

In former times lions were believed to throw large animals, such as oxen and buffaloes, across their backs and carry them off bodily in this summary fashion; but modern observers agree in regarding this as impossible, and that the bodies of large animals are dragged along the ground. The same holds good even for small antelopes; and in no case would a lion be able to jump over a high fence with an ox or a buffalo on its back.

When dragging away their prey, lions do not present the majestic appearance which we observe in zoological gardens when we see one of these animals standing with head erect, apparently gazing into space.

In Africa the lioness generally produces three or four cubs at birth, but in India the number is stated not to exceed three, and to be often only two. When playing with their cubs, lions are remarkably like ordinary cats; and in captivity they often become almost as tame as the latter, the fact of their being more dangerous being largely due to their superior strength and size, and not to a greater inherent ferocity of character.

Leopard.

As leopards have been referred to in the chapter on the animals of Asia, it will suffice to mention in this place that they range all over the African continent; and that in the mountains of Morocco they are represented by a large-spotted race, which, together with another from East Africa, approximates in its markings to the Asiatic races of the species much more than do the ordinary small-spotted African leopards. Yet another race (*Felis pardus nimr*), inhabiting the Red Sea littoral and Abyssinia, is greyish in ground-colour, in some cases nearly black along the spine. Black leopards occur in Abyssinia and East Africa.

Wild Cat.

The European wild cat is represented in Africa by a nearly allied but shorter-haired species (*Felis ocreata*), of which the typical Egyptian race is believed to be the original ancestor of the domesticated cats of Europe. In both the European and the African wild cat the body is marked with transverse dark stripes; but these tend to disappear to a greater or less degree in the adults of the latter. In the African species, which is found in Sardinia as well as over the greater part of Africa, the four dark stripes on the top of the head are much less distinct than in its European relative, and if present at all on the nape of the neck are narrower and closer together. Eastwards this cat ranges into Syria and Arabia. The northern race was tamed by the ancient Egyptians, who have left at Bubastis and Beni-Hassan vast numbers of its mummified carcases. One of the ancient Egyptian frescoes in the British Museum represents a scene in which fowlers are accompanied in a boat by a tame cat which was probably trained to assist in the capture of birds.

Serval.

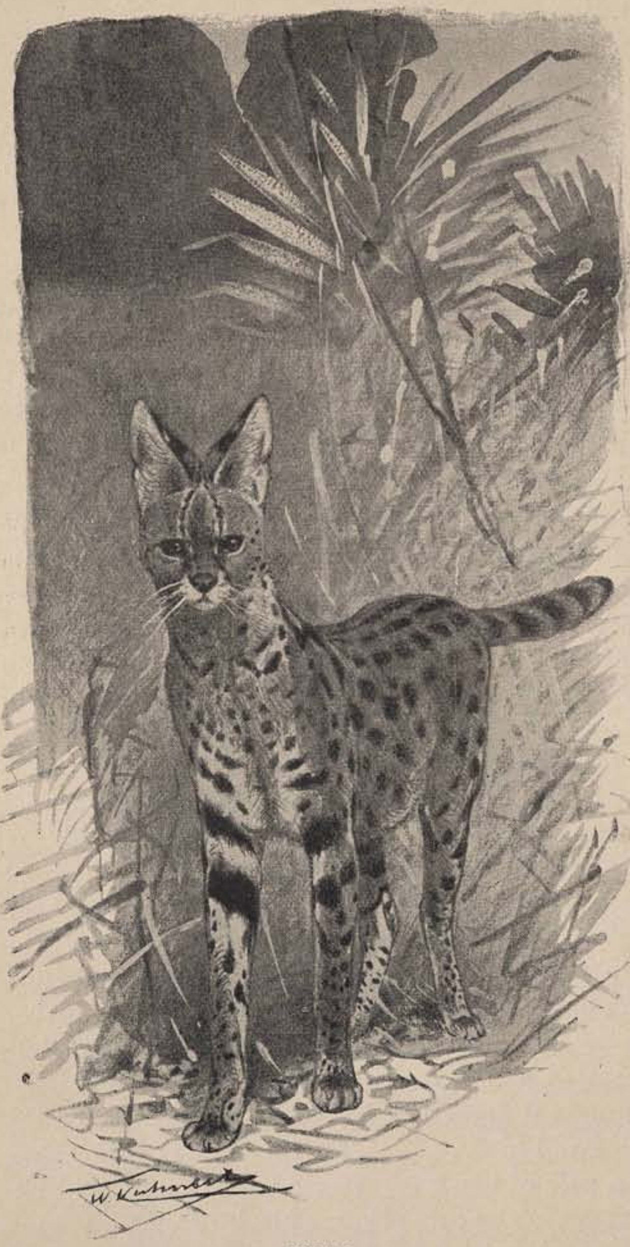
Another species of cat met with in North Africa and likewise ranging over the greater portion of the continent is the serval (*F. serval*), of which there are several local varieties or races, while wholly black individuals are occasionally killed. In consequence of the length of its limbs and the shortness of its tail (which is scarcely half the length of the head and body) the serval is by no means such a graceful animal as many other members of the cat tribe. The general colour of the fur is light fawn, with a more or less distinct tinge of orange, passing into whitish on the under-parts. Upon this are a number of solid black spots arranged in rows on the flanks and back, and on the middle line of the back becoming so elongated as almost to blend into parallel stripes. These spots are, of course, totally different from the light-centred rosettes of the leopard. Although the cheeks are devoid of dark bars, the inner side of the upper part of each fore-leg is marked by a pair of black transverse bands. and the black-tipped tail ornamented with sable rings. The ears also are black behind, although relieved by a light spot near the tip. A large serval will measure as much as 40 inches to the root of the tail, while that appendage may reach a length of 16 inches.

Jungle-Cat.

North Africa is also the home of a local race of the jungle-cat (*F. chaus*), a species of which the typical race is a native of India. The African race (*F. c. nilotica*) of this well-known species is characterised by its relatively large size, and dark, grizzled ears, which differ in colour but little from the rest of the head.

Caracal. A totally different type of cat is the caracal or red lynx (*F. caracal*), a whole-coloured rufous species, with black ears, which forms in some degree a connecting link between the more typical representatives of the *Felidæ* and the true lynxes of the Northern Hemisphere. The range of the caracal is very extensive, reaching from Cape Colony through the desert districts of eastern Africa, Syria, and Persia to the plains of India. The North African race, which is of large size, has been named *F. c. berberorum*.

Hunting-Leopard. Another member of the cat tribe common to Asia and Africa is the hunting-leopard, or chita (*Cynælurus jubatus*), a large, long-legged animal, with spots recalling those of the serval, but distinguished from all other *Felidæ* by its non-retractile claws. As the hunting-leopard has been already referred to in the second volume, a very brief notice will suffice in this place. The distribution of the African race (*C. j. guttatus*), although known to be extensive, has not yet been fully defined. The species is, however, reported to be generally rare in the south-east of the continent, but comparatively common in the rocky ravines of the Bengo Mountains, where it frequents dense forests, from which it issues forth to hunt its prey on the neighbouring plains.



SERVAL.

Hyæna and Civet-Tribe. The striped hyæna (*Hyæna striata*) is yet another carnivore common to India and northern Africa, its range including also Arabia and Palestine, and in Africa extending all through the northern districts and a considerable distance down the east coast. The northern race, as typified by the Tunisian representative of the species, has been named *H. s. suilla,* while to the Abyssinian race has been given the title of *H. s. hienomelas,* and to the East African form that of *H. s. schillingsi*; but the differences between all of these are only slight. Of the civet tribe (*Viverridæ*) it must suffice to mention that the genet (*Genetta vulgaris*) is a characteristic Mediterranean species, whose range includes southern Europe, south-eastern Asia, and North Africa; and that the Egyptian mongoose or ichneumon (*Herpestes ichneumon*) has likewise a very similar distribution.

Jackals.

Passing on to the dog tribe, or *Canidæ,* we find that northern Africa has two kinds of jackal peculiar to itself. The first and larger of these is the Egyptian jackal (*Canis lupaster*), which is in fact the largest and most wolf-like of its tribe. True wolves, it may be added, are unknown anywhere in Africa. Measuring about 50 inches in total length, the Egyptian jackal stands as much as 16 inches at the shoulder. Its general colour above is yellowish grey stippled with black; but the muzzle, the backs of the relatively short ears, and the outer sides of the limbs are redder; while the hairy portions of the lips are white, and the terminal portion of the tail is darker than the back, with the tip black. The range of this species in Egypt does not apparently extend south of the first cataract, or eastwards of the Red Sea. The Morocco jackal (*C. anthus*), of north-western Africa generally, whence it extends as far south as Senegal, is a smaller, paler, sharper-nosed, longer-eared, and more lightly built animal than the Egyptian species.

Fox and Fennec

The common fox (*C. vulpes*) is represented in northern Africa apparently by three varieties, of which the Algerian race appears indistinguishable from the south European *C. v. melanogaster.* The fox of the Atlas Mountains has been separated as *C. v. atlanticus,* and the one inhabiting the Nile Valley as *C. v. ægyptiacus.* A very distinct and characteristic animal of this tract is the fennec (*C. zerda*), of which the majority of specimens that reach Europe arrive from the Sahara by way of Algeria. The length of this little fox is only about 15 inches to the root of the tail; the length of that appendage being about 7 inches. In colour it is pale reddish fawn above and white beneath, with a black tip to the tail, and the usual dark gland-patch on the upper surface of the latter near the root. The long and wide ears are reddish brown externally, with a number of long and nearly white hairs along the inner margin. Fennecs are sociable animals, making their burrows together.

Ancient Domesticated Dogs.

Apart from certain undetermined breeds depicted in the monuments of the Pharaonic period, mummified *Canidæ* from Assiout and other localities in Egypt include four breeds of domesticated dogs The first of these is the ordinary Egyptian pariah, described as a feeble representative of the typical pariah of Constantinople. The second breed is the one referred to in the papyri as *tesem,* which was formerly regarded as a greyhound, but which appears, both from the skeleton and the frescoes, to be more like a large mongrel terrier, with upright ears and a long tail carried curled over the back. It was a relatively long-legged dog, with a short greyish yellow coat, and broad, prominent forehead, and in size somewhat exceeded the pariah. The third type, apparently the commonest of all, may be called the Egyptian house-dog, and was considerably smaller than the *tesem*, but having a skull of similar type. Compared with that of the pariah, the skull is shorter and broader, with a much more elevated and prominent forehead. The fourth and last type is termed the Egyptian spitz, or *loulou*, and is said to resemble a breed still existing. It is considerably superior in size to the typical large Pomeranian, or spitz, and approximates to the mastiffs. The skull, which measures about 7½ inches in length, and has a highly elevated forehead, indicates a very powerful dog, agreeing in this respect with its modern counterpart, the spitz of the Bedouins. There does not, however, appear to be any skull which can be referred to the prick-eared and long-muzzled Ibiza greyhound, or the slughi, the former of which is so often represented in the Pharaonic paintings, and still survives in Majorca, while the latter is the favourite dog of the Bedouin. In addition to domesticated breeds of dog, the mummies from Assiout include both jackal and fox.

Brown Bear.

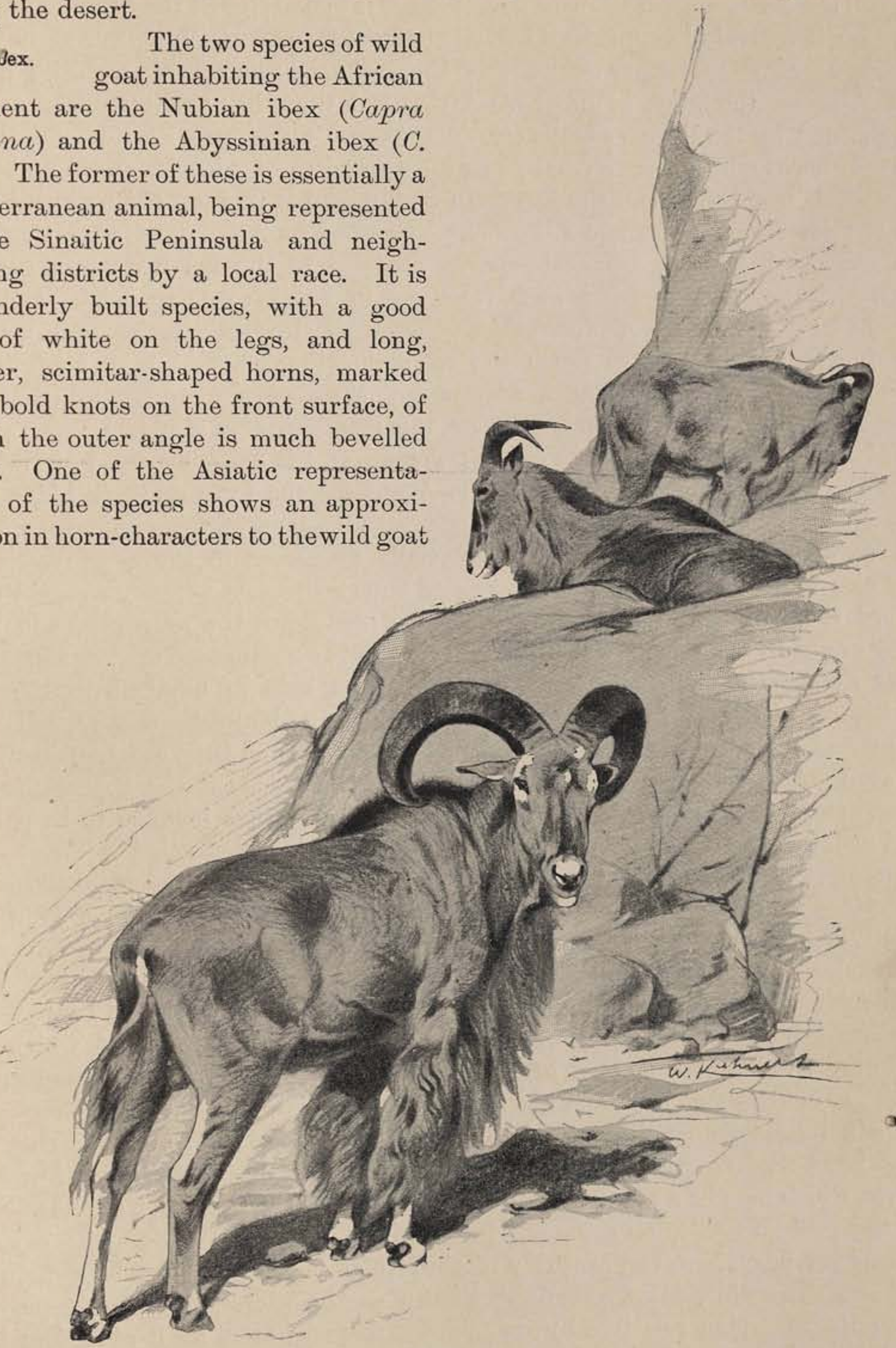
Although bears are unknown in the east of Africa, the Atlas Mountains and certain other parts of northern Africa are reported to be the home of a little-known local race of the brown bear (*Ursus arctus crowtheri*) said to be nearly black in colour, but no specimens are now known.

Striped Polecat.

Passing on to the *Mustelidæ*, or weasel tribe, it may be noted that the zorille or striped polecat (*Ictonyx frenata*), the typical representative of a peculiar genus, inhabits Egypt and Sennar, and likewise those parts of south-western Asia bordering on the African continent, as well as the districts round Constantinople. Although the colouring is of the same general type as that of the American skunks, with which the striped polecat also agrees in its insufferable odour, there appears to be no near relationship between these two groups. The striped polecat is a rough-haired animal, brownish black in colour, with yellowish white longitudinal stripes; like a skunk, it carries its bushy tail bent forwards over its back. In general habits it appears to be very similar to ordinary polecats, which, like martens, are unknown in Africa. To the natives of the Sudan the creature is known by the name of abu-æffu, signifying "father of smells."

Udad or Arui.

Wild cattle, except in the shape of buffaloes, are entirely absent from Africa, where wild sheep are represented only by the arui or udad (*Ammotragus lervia*), which represents a genus by itself, and inhabits the steeper slopes of the dry southern side of the Atlas range, and extends from the Atlantic coast and the desert south of Biskra to the mountains of Egypt and the northern part of the Sudan. This species is broadly distinguished from other wild sheep by the mass of long hair developed on the throat, chest, and fore-legs, as well as by the length of the tail, which is thickly haired and reaches below the hocks. The long hair of the under-parts is developed only in the rams, the ewes having much shorter hair on the fore-quarters. The horns, which are well-developed in both sexes, seldom exceed about 25 inches in length in rams, and are unlike those of other wild sheep, both in shape and in the structure of their external surface, being directed to a great extent outwards, with but little curvature, and the ordinary wrinkles replaced by finer criss-cross markings. In height the arui stands over 3 feet at the shoulder. Its uniformly pale reddish yellow colouring harmonises to perfection with that of the limestone rocks of its native mountains, where it is reported in Algeria and Tunis to keep to the side facing the desert.



ARUI.

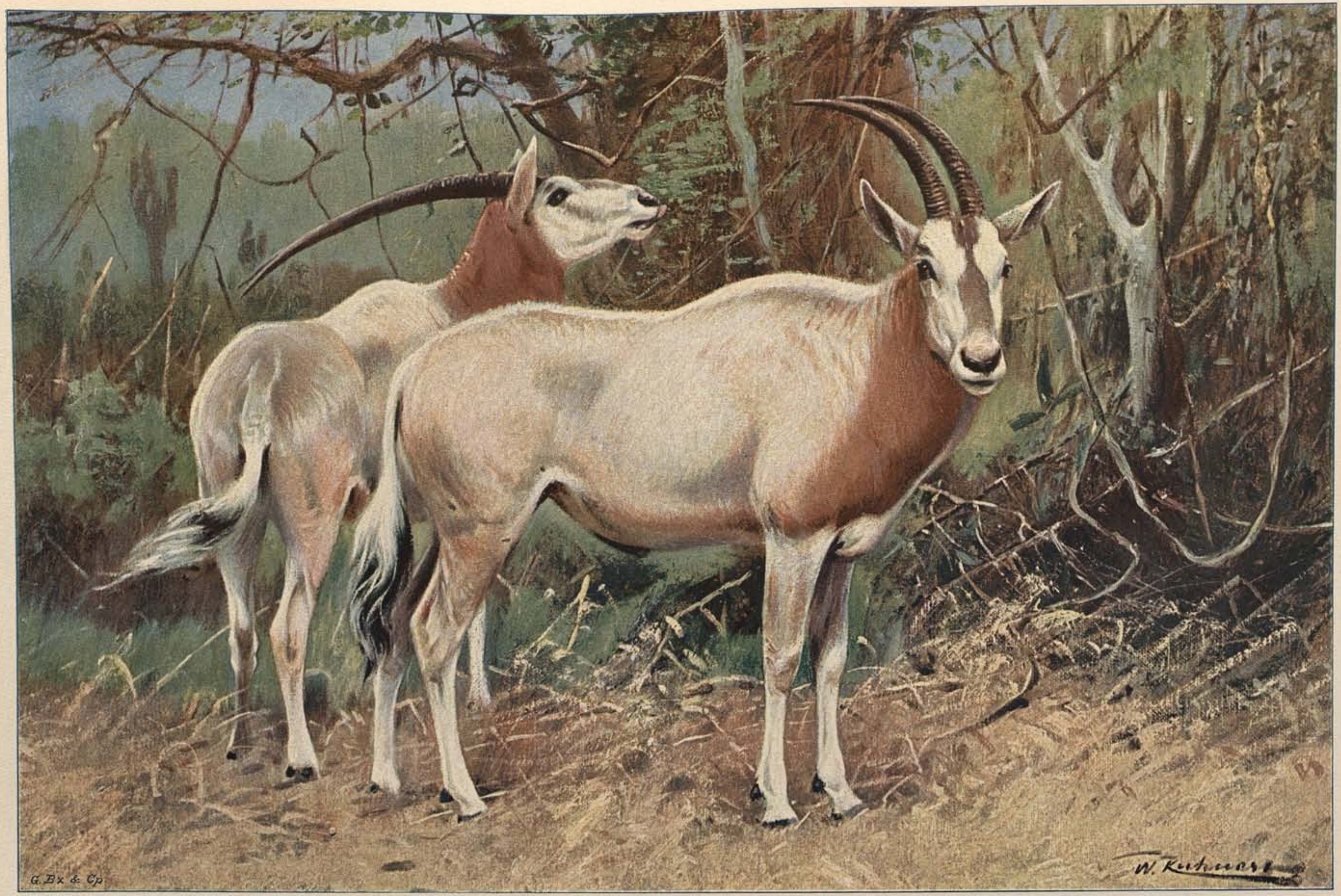
Ibex.

The two species of wild goat inhabiting the African continent are the Nubian ibex (*Capra nubiana*) and the Abyssinian ibex (*C. vali*). The former of these is essentially a Mediterranean animal, being represented in the Sinaitic Peninsula and neighbouring districts by a local race. It is a slenderly built species, with a good deal of white on the legs, and long, slender, scimitar-shaped horns, marked with bold knots on the front surface, of which the outer angle is much bevelled away. One of the Asiatic representatives of the species shows an approximation in horn-characters to the wild goat of southern Europe and Asia. Westwards this ibex probably ranges into Morocco. The Abyssinian species, on the other hand, is much more heavily built, with a rich reddish brown coat merging in places into black, and enormous black horns on which the knots are but slightly developed. It is a native of the high mountains of Simien, in central Abyssinia, and has only of late years become fully known in Europe.

Gazelles. Further evidence of the intimate relationship existing between the fauna of northern Africa and the other Mediterranean countries is afforded by the Dorcas gazelle (*Gazella dorcas*), a species with the typical lyrate gazelle-horns which ranges from the wilder districts of Algeria, Tunis, and Tripoli eastwards into Egypt and the Egyptian Sudan, and is represented by allied species in the deserts of Syria and Palestine. The edmi, or Atlas gazelle (*G. cuvieri*) is, on the other hand, a mountain-species confined to the north-western corner of Africa, although possessing near relatives in south-western Asia. The rhim, or Loder's gazelle (*G. leptoceros*), characterised by its slender and comparatively straight horns, has much the same distribution, and may be found not uncommonly in parts of Tunis, Algeria and the Sudan.

According to an English sportsman, the rhim—Arabic *el rhime* and Tamahaq *hankut*—is the common gazelle of the Sahara. In the neighbourhood of Rhadamis great numbers of them are killed by the Arabs for the sake of their hides, which are dressed and coloured with a dye made from the rind of pomegranates previous to exportation. These gazelles are especially numerous in the Ergs district, but are also found in all parts of the Sahara where there is sufficient vegetation to afford them nutriment. Northwards of El-Oued-Souf, the only places in which they are to be met with are the district lying to the south-west of Bou Chama and near Sef-el-Menadi. Their horns are offered for sale in numbers in the bazar at Biskra, where skins may likewise be occasionally obtained. Some specimens of the horns of the bucks are so like those of the edmi that they are frequently sold as such. As a rule, however, the horns of the rhim present the appearance of a long, evenly tapering V, while those of the edmi are more inclined to be parallel, and usually take a forward and inward turn a little below the tips.

White Oryx and Addax. Most of the North African mammals mentioned above are, as already mentioned, essentially Mediterranean types, having near relatives in southern Europe or south-western Asia. We come now to two which are exclusively African, or rather we might say Ethiopian, in distribution; the term Ethiopian Africa being a convenient one to apply to that portion of the great continent lying to the south of the northern tropic, the fauna of which is so essentially different from that of North Africa, Europe, and Asia. These are the white oryx (*Oryx algazel*) and the addax (*Addax nasomaculatus*), both of which have a light-coloured dress specially adapted to a desert existence. The white oryx has a relative—the Beatrix oryx (*Oryx leucoryx*)—in the deserts of Arabia and Syria, which may be a survivor marking the route of the migration of the ancestors of the modern Ethiopian mammals into Africa from India. The white oryx and the addax have, however, probably reached their present habitat by crossing the Sahara. The white oryx, sometimes known as the sabre-horned antelope, differs from its Ethiopian relatives by its scimitar-shaped horns, as it also does by its buffish white coat with patches of bright chestnut. These chestnut patches, it may be added, doubtless indicate the original colour of this antelope before it took to a purely desert existence.



SABLE ANTELOPE.

Although now unknown in the country, in Pharaonic times the white oryx was an apparently common animal in Egypt, as is demonstrated by its occurrence in the bas-reliefs and frescoes, where it is represented in a variety of postures and under many different circumstances. In some cases, for example, it is being led by Nubian slaves, in others it is being seized by dogs or shot by archers, while there are other instances in which it is depicted as being immolated for sacrifice, while in another it is being dismembered by slaves, apparently for the table. Some of the coloured frescoes clearly show that the white oryx is the animal intended, the sabre-like horns being unmistakable, while in one instance the red shading seems intended for the chestnut on the neck. In a few pictures, however, the horns are straight, from which it has been inferred that they are intended to be portraits of the beisa oryx (*O. beisa*) of Somaliland and East Africa, although, as too much stress should not be laid on the shape of the horns, it may be that all the figures relate to the white oryx. The latter theory is supported not only on distributional grounds, but from the absence in the frescoes of any indications of the distinctive black markings of the beisa. Apart from this point, the evidence of the frescoes may be taken to prove that the white oryx inhabited Egypt, as indeed might naturally be surmised, seeing that the animal is essentially a member of the North African fauna. It was taken alive or killed by hunters, and its meat offered for sale in the butchers' shops of the day, as is demonstrated by certain frescoes other than those mentioned above; but there was no evidence that it was in any sense a domesticated animal, although specimens may have been, and probably were, kept in confinement for a time.

Under the third dynasty, it appears, the oryx was known by the general term *rau*, which might be applied to any animal, either wild or tame, although more frequently to the latter. Under the fourth dynasty the name became particularised by the addition of the syllable *hez*, signifying white; so that we have *rau-hez*, *i.e.* the white oryx, a clear indication that we have to do with *O. leucoryx*, and not *O. beisa*. On one tomb, however, the animal is designated *rau-ma*, the syllable *ma* denoting in a general way any desert beast. Finally, from this terminal *ma* and the adjective *hez* was formed the compound *ma-hez*, *i.e.* the white beast of the desert, which became the distinctive title of *O. algazel*, and persisted without modification till the Greco-Roman period. It may be added that the designation *ma* is frequently applied to the lion, and gave origin to the Coptic name of that animal. The full and distinctive Egyptian title of the lion was, however, *ma-hes*, *i.e.* the enchanting or fascinating beast of the desert (*bête fascinatrice du desert*). It further appears that *ma-hez*, the ancient Egyptian designation of the white oryx, is the same word as *beisa*, more accurately *beiza* (with the Arabic *za*), the Sudani title of *O. beisa*; the Danakil name being *beiîda* and the Somali *beid*. According to a French naturalist, in this name the final consonant is, then, either *z*, as in Egyptian, or *d*. As regards the first part of the word, it is clearly composed of two syllables, *be-i*, *ba-ï*, and even *ve-ï*, with, between the two vowels, a sound which has been considered to be the Arabic *aïn*. It appears, however, that the supposed *aïn* is in reality *h*, as is shown by a recent transcription of the Somali name *bheït*. Hence the various forms of the name in tropical Africa appear to follow the types *behiza*, *bahida*, *behid*, *beheït*. If instead of the initial *b* we may admit an *m*, we have exactly the word *ma-hez* of the Egyptians, a word which, according to the epoch, is pronounced either *ma-hed* or *ma-het.* Finally, it seems that the African names *behiza, bahida, beheït*, and the Egyptian name *ma-hez*, pronounced later *ma-hed* and *ma-het*, are in reality the same; and the only question remaining for consideration is whether the Egyptians borrowed it from their southern neighbours, or whether the latter took it from the Egyptians.

The addax is characterised by the open spiral formed by the horns, which, like those of the oryx, are common to both sexes, and are ringed almost throughout their whole length, and incline backwards nearly in the plane of the face. The shoulder-height is a little over 3 feet, and the horns measure from 26 to about 35 inches along the spiral. The greater part of the body is clothed with short, close hair, but the forehead carries a mass of long brown hair, and in winter a mane of similar hair covers the neck. Yellowish tawny is the general colour of the addax in summer, but in winter the tone is greyer; at all seasons there is a white band above the eyes. Like the white oryx, the addax ranges right across northern Africa, from the Sahara to the Egyptian Sudan. The addax is hunted by the Arabs not only for the sake of its flesh, but for the purpose of training their horses and slughi hounds; the parties often remaining out for weeks together.

Bubal Hartebeest.

Another essentially Ethiopian type of antelope inhabiting northern Africa is the bubal hartebeest (*Bubalis boselaphus*), a small-sized member of an extensive group of large African antelopes characterised by their generally foxy colour, long, melancholy-looking faces, crowned with a pair of ringed and more or less sharply bent black horns of no great length, elevated withers, and long, tufted tails. The range of the bubal includes a large part of northern Africa, but does not, as formerly supposed, extend into Syria and Arabia; the same holding good also for the white oryx and the addax. The bubal is the smallest representative of the hartebeests, standing some 37 inches at the withers. In colour it is uniformly reddish brown. On the crown of the head is a pedicle, from which, in both sexes, spring the relatively short and thick horns; these attaining a length of from 13 to 14 inches, and curving in the form of the letter U. The bubal is exterminated from the greater part of Tunisia: in West Africa it is replaced by the much larger western hartebeest (*B. major*).

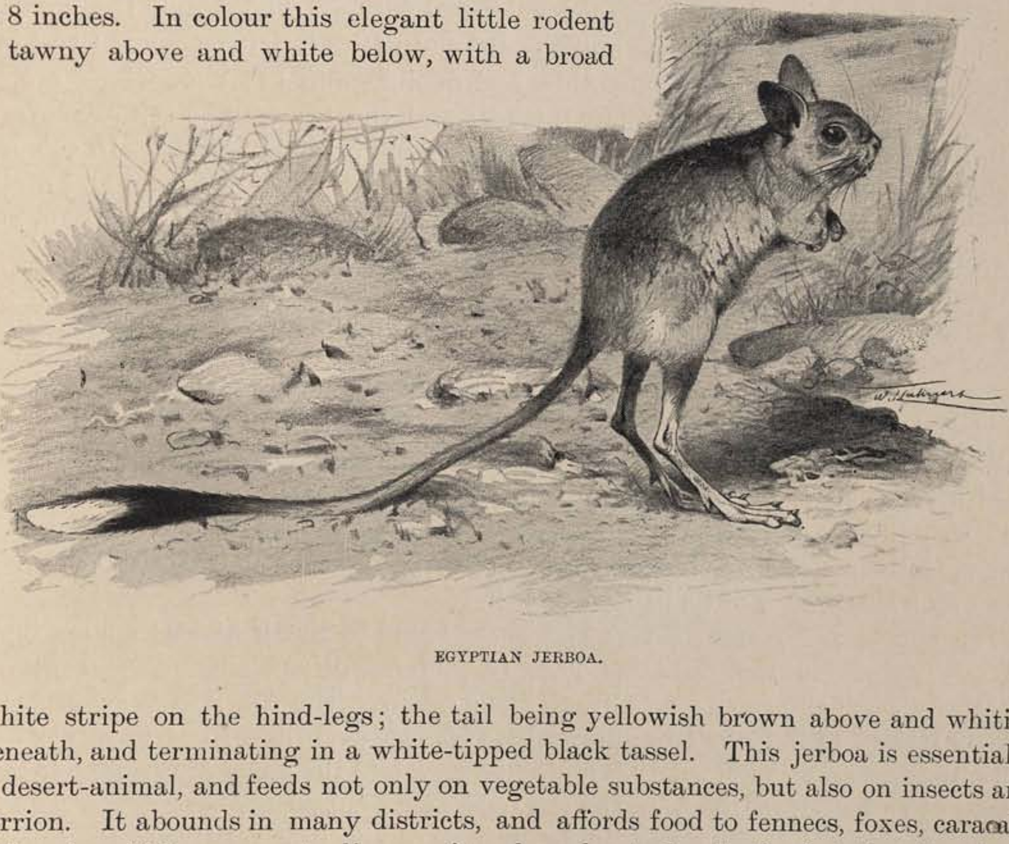
Deer.

Among the negative peculiarities of the fauna of Ethiopian Africa is the total absence of the deer tribe, or *Cervidæ*. Northern Africa, on the other hand, shows its affinity to other Mediterranean countries in possessing a small race of the red-deer, commonly known as the Barbary deer (*Cervus elaphus barbarus*). This deer, which is near akin to the Corsican stag (*C. e. corsicanus*), is characterised by the absence of a brow-tine to the antlers of the stags, and the frequent retention of light spots in the adult, as well as by its small stature. Its chief haunts are formed by the strip of forest-country extending from the Mediterranean coast on the frontiers of Algeria and Tunis southwards to the Sahara.

Although there appears to be no evidence of the existence of truly wild fallow-deer (*C.* [*Dama*] *dama*) in northern Africa during the nineteenth century, it seems probable that this essentially Mediterranean species once inhabited certain portions of the north-western corner of the African continent, more especially the eastern side of Algeria.

Wild Boar. True swine are likewise absent from the fauna of Ethiopian Africa, but the forests of Morocco and Algeria are the home of a race of the European wild boar (*Sus scrofa ferus*), which appears to have but slight claims to distinction from the typical race of this well-known species.

Jerboa. Leaving the ungulates and turning to the rodents, we find a very characteristic North African species in the Egyptian jerboa (*Dipus jaculus*, or *Jaculus jaculus*), whose range extends from Algeria through Egypt to Algeria. All the jerboas of the same genus are characterised by having only three toes to each hind-foot. In the Egyptian species the head and body measure about 7 inches, while the length of the tail is as much as 8 inches. In colour this elegant little rodent is tawny above and white below, with a broad white stripe on the hind-legs; the tail being yellowish brown above and whitish beneath, and terminating in a white-tipped black tassel. This jerboa is essentially a desert-animal, and feeds not only on vegetable substances, but also on insects and carrion. It abounds in many districts, and affords food to fennecs, foxes, caracals, and owls, which manage to discover its whereabouts despite the fact that its colouring, like that of numerous other animals, such as the desert-lark, desert-courser, and various lizards and snakes, is the same as that of the desert-sand, so that it is recognisable as a living being only at a very short distance. Its extraordinary shyness makes the jerboa—which leads a generally nocturnal life, although often appearing before sunset or even in full sunlight in front of its burrow—disappear into its hole at the slightest noise. According to Arab report, several jerboas excavate their holes in company by means of their incisor teeth and small fore-feet, the latter of which are scarcely visible when the animal is jumping, or walking. If they have left their holes at a certain distance and are suddenly startled, they run,



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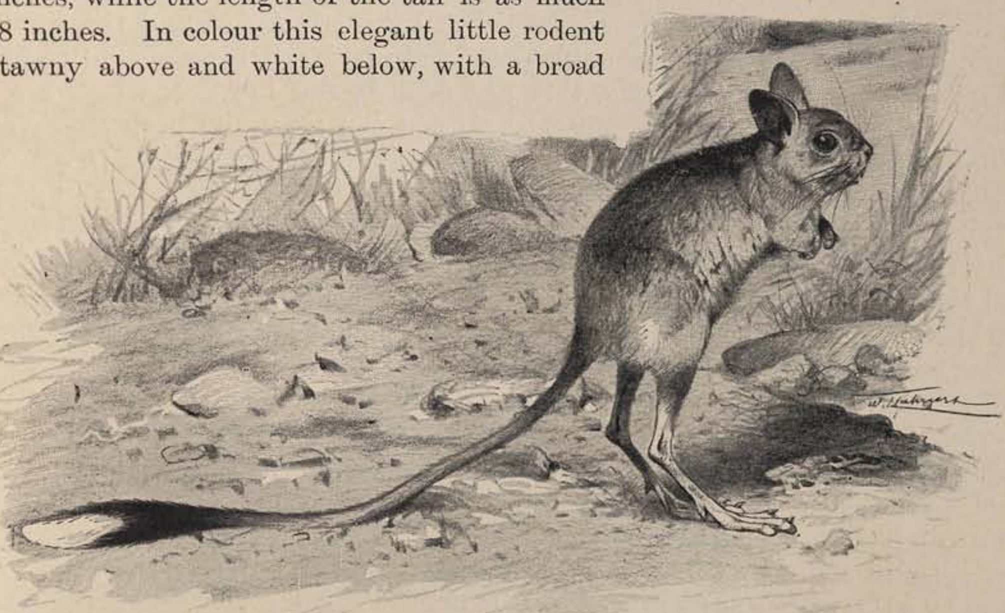


EGYPTIAN JERBOA.

with their long tails extended backwards, with such long and rapid leaps across the desert that they might well be taken for birds in flight. When walking quietly, however, they put down one foot after the other in a deliberate manner. Being true desert-animals, moisture, especially in the form of rain, does not suit them at all; and if wet weather continues for some time, they fall into a kind of stupor.

Striped Mouse. Another common North African rodent is the Barbary striped mouse (*Acomys barbarus*), which abounds in the Atlas, and is found so far south as Kordofan. It belongs to the typical group of the mouse family, but is distinguished from the members of the genus *Mus* by its coloration, which consists of a number of blackish brown stripes running along the yellowish brown back.

Porcupine. The common porcupine (*Hystrix cristata*) is a Mediterranean rodent, ranging over northern and western Africa and the south of Europe. Apart from the hollow quills at the end of its tail, it possesses two kinds of spines; some being very long, thin, and flexible, and the rest, which are set between the long ones, shorter and thicker; and the head and neck are covered with long bristles, curving backwards so as to form a kind of mane. In colour it is chiefly brownish black, with a white band running across the front and up the sides of the neck, where it becomes narrower. The bristles of this mane are mostly brown at the base, but otherwise white; the long spines are white at their bases and tips, and elsewhere ringed with black and white, those on the hind-parts are black throughout, and the hollow quills at the end of the tail white, as are most of the other quills of the tail.

Porcupines inhabit rocky mountains, where they spend the day in caves, crevices in rocks, or burrows dug by themselves. They feed exclusively on vegetable substances, especially roots, although they also devour wild fruits and garden-vegetables. On account of such delicate diet, their flesh, which is said to be partly like pork and partly like veal, is of excellent quality; and they have consequently a great number of enemies, among them the leopard, which kills them by a single blow of its paw on their heads.

Hares. Several species of hares are found in North Africa; among them being the Egyptian hare (*Lepus ægyptius*), characterised by its relatively small size, very long ears, and pale colour. The Algerian *L. kabylicus* is nearly related to the small Sardinian hare (*L. mediterraneus*) but of larger size. The Tangier hare is known as *L. schlumbergeri*, and the name *L. tunetæ* has been applied to a hare from the island of Kerkenna, off Tunis.

The absence of the European squirrel, or of any near relative of the same, is a noteworthy feature in the zoology of northern Africa.

Perching Birds. Among the birds of northern Africa are a very large number of representatives of the perching group. In this group the diadem-redstart (*Ruticilla moussieri*) is a native of north-western Africa, and is said to occur also in Spain. About the size of the common redstart, it is distinguished by a white stripe running from above the eye to the neck, a triangular white spot on the folded wings, and a rich red throat and breast. This pretty little bird seems indeed to combine the characteristics of the redstarts and the stonechats, constantly bowing its head like other redstarts, but lacking the vibrating movements of the tail peculiar to the other members of the group. It resembles the whinchat in its fondness for perching on a projecting branch so as to obtain a good view all round, but is equally at home among bushes and tree-tops. In Tunis and elsewhere it keeps to the hills with grassy slopes. The stonechats have also a noteworthy north-west African representative, which ranges into Spain and Italy. This is the black chat (*Saxicola leucura*), the male of which in the breeding plumage is rusty black in colour, save for the white upper tail-coverts. On account of its handsome plumage, the white portions of which are shown off to the best advantage by the graceful attitudes of the bird, as well as by its liveliness and its melodious song, the black chat is one of the most striking denizens of the rocky country in which it dwells. Another songster of north-western Africa is the melodious warbler (*Hypolais polyglotta*), distinguished from other members of its genus by the greyish brown legs. Out of Africa, the range of this species includes Italy, Spain, and France. A well-known North African song-bird, which ranges as far north as England, is the furze-warbler (*Sylvia undata*), its African representative being distinguished as *S. u. toni*, while the English bird, commonly known as the Dartford warbler, is termed *S. u. dartfordiensis*.

As the sand-larks are represented in northern Africa and south-western Asia by the desert-lark, so the bullfinches have a representative in the desert-bullfinch (*Bucanetes githaginea*), of which the range extends from the Canaries in the west through northern Africa and south-western Asia to India. On the upper-parts this bird is cream-coloured with a pinkish tinge, and pale pinkish below, while the cheeks and under-parts are pale pink, the feathers of the wings and tail dark brown with pink edges, and the beak pink. These birds, which are rather smaller than ordinary bullfinches, inhabit the most barren parts, and live, except during the breeding-season, in small flocks amid the reddish yellow rocks and sands of the desert, where they would be scarcely noticeable did they not attract attention by their trumpet-like call-notes. Another type of colouring is presented by the canary (*Serinus canarius*), which is so much like the serin-finch—also indigenous to North Africa—that it has been regarded as specifically inseparable. Although slightly larger, in its winter-plumage it is indeed almost exactly like the serin; but in summer it develops a yellowish green head, tinged with grey at the back, an olive-brown back shaded with rusty brown and blackish brown streaks, a yellowish green rump, greenish yellow and white under-parts, streaked sides, and blackish brown quills and tail feathers edged with green. The wild canary inhabits the Canary Islands (which really belong to Africa), or at least is found in most of them, and is so common at Las Palmas that the question arises as to where all these birds breed. On the coast of Teneriffe, the breeding-season begins in January, but on the high mountains not till June. The song, although powerful and melodious, is not so varied as that of the domesticated canary, which is descended from the wild bird.

In the typical finch-group the Algerian finch (*Fringilla spodiogenys*) is but little different from its well-known European representative the chaffinch. It is, however, grey, not only on the crown, but also on the cheeks; the yellowish green area extending on to the back, while the under surface is dull white with a delicate reddish tinge. Another species, the Azores finch (*F. canariensis*), which inhabits not only the isles from which it takes its English name, but likewise Madeira, and the Canaries, is also very similar to the chaffinch, differing by the blackish crown, dark grey neck and back, cream-coloured sides of the head and under-parts, white chin, and grey flanks. A third member of the same group is the Teneriffe finch (*F. teydea*), of the island from which it takes its name, a species somewhat larger than a chaffinch. The cocks are blue above and lighter below, while in the hens the back is olive-brown and the under surface pale grey. This comparatively rare bird is a native of pine-woods, where it feeds on pine-seeds, which are readily extracted by its strong beak from the cones.

The African magpie (*Pica mauritanica*), which brings us to the crow tribe, is remarkable in that it comes nearer to the Californian representative of the genus than to the European species. Somewhat smaller than the latter, it has shorter wings, a black back, and a bare blue patch behind each eye. In the last-mentioned respect it resembles the Californian magpie, from which it differs by its yellow beak. The carrion and the grey crow both occur in North Africa, where, as in Europe, they inhabit separate areas, the former being found in north-western Africa, and the latter in Egypt. Of the shrike tribe, there are several representatives in this area; among them being the masked shrike (*Lanius nubicus*), which winters in Nubia, whence it migrates to southern Europe. Frequenting the neighbourhood of cultivated grounds, this species feeds chiefly on insects, and nests in olive-trees. An Algerian species, which builds in bushes, and never perches on projecting boughs, is the northern hooded shrike (*Pomatorhynchus senegalus*), which ranges into tropical Africa, but is replaced in the south of the continent by *P. tschagra* (*erythropterus*).

Woodpecker.

The only member of the so-called picarian birds demanding mention here is the Algerian green woodpecker (*Gecinus vaillanti*), which is a North African species closely related to the green and the grey-headed woodpeckers of Europe.

Birds-of-Prey.

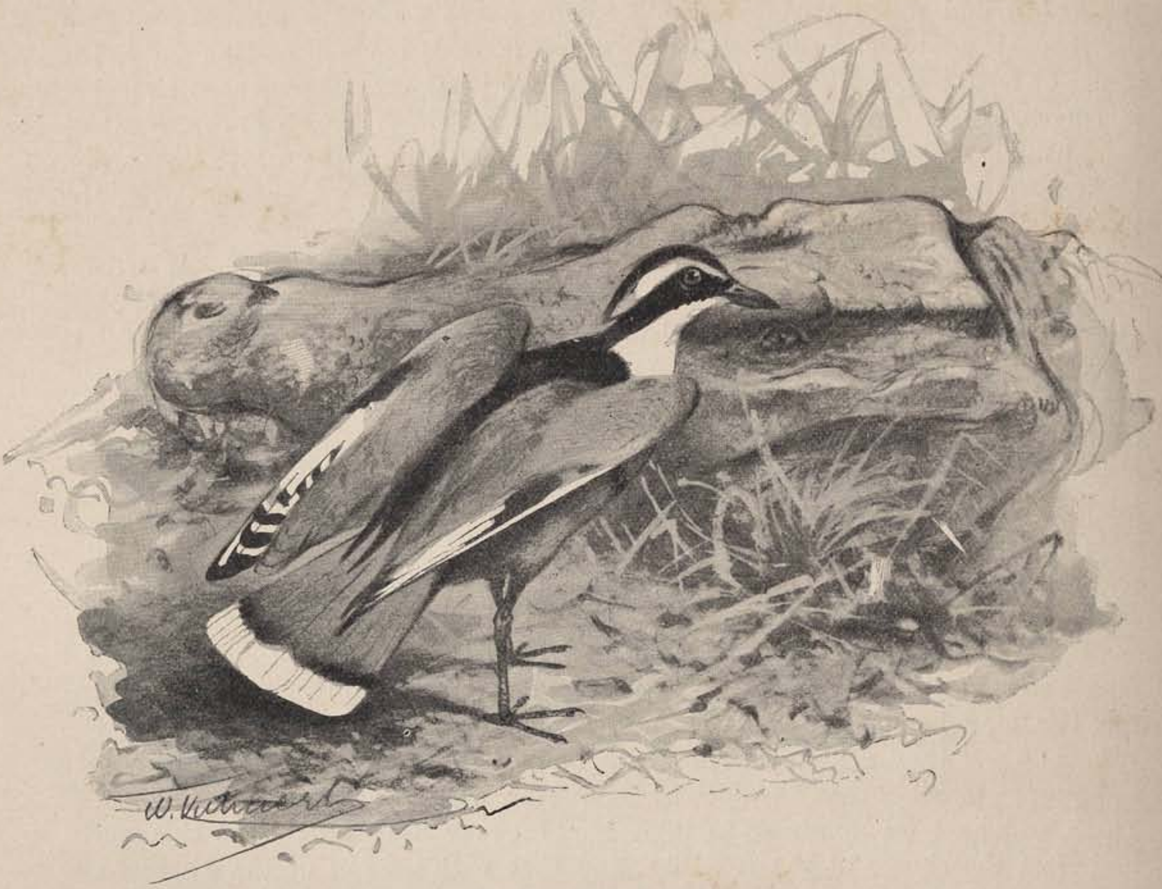
Among the nocturnal birds-of-prey the eagle-owls have a North African representative in Pharaoh's owl (*Bubo ascalaphus*), whose plumage is yellowish brown in colour with spots of dark brown and white. In the diurnal group north-western Africa is the home of the white-shouldered eagle (*Aquila adalberti*), also known as the Spanish imperial eagle, a species so closely resembling the European imperial eagle, more especially when young, that at this age it is scarcely distinguishable. Later on, however, it differs by having a white patch on the carpal joint of the wing. It also occurs in Spain. Sea-eagles are represented throughout the whole of the African continent by *Haliaëtus vocifer*, a species inferior in point of size to the northern members of the genus, and distinguished by the white head, breast, and tail, the reddish brown under-parts, lower wing-coverts, and upper wing-margins, and the black feathers of the rest of the wings and shoulders. Besides the black kite (*Milvus ater*), which is common to Europe, North Africa is the home of the Egyptian kite (*M. ægyptius*), a species differing from the former by the yellow beak, and, in old age, the brown head. This bird is one of the street-scavengers of North African towns, as is also the well-known white scavenger-vulture (*Neophron percnopterus*) of the whole of northern Africa, commonly called Pharaoh's hen. The contrast of the black quills to the white of the rest of the plumage renders the former an unmistakable bird.

Game-Birds. Among game-birds, two kinds of mountain-partridge inhabiting the Mediterranean province are found in northern Africa, namely, the Barbary red-legged partridge (*Caccabis petrosa*) and the European red-legged *C. rufa*. The latter chiefly inhabits mountain plateaus abounding in heather, oak-bushes, rosemary, rock-roses, and thyme, as well as rocky hills, where similar vegetation grows, and even on bare rocks. It is indigenous to the neighbourhood of the Atlas, but also occurs in southern France, Spain, Portugal, Madeira, and the Azores, and was introduced into England about a century ago. Red-legged partridges resemble the common grey species in their mode of nesting and in the choice of food, but, unlike the latter, occasionally perch on trees. About 13 inches in length, the European red-legged species has a reddish brown crown, a white band behind the eye, a moderately broad dark band across the white throat, and black spots below the throat-ring; its most distinctive mark being, however, the broad black-edging to the chest-feathers.

Storks. Those stately birds, the storks, are common objects in an African landscape; among them being the saddle-beaked stork (*Ephippiorhynchus senegalensis*), the males of which stand 5 feet in height. This species, which is the largest, as it is one of the handsomest, of its kind, ranges from the Blue and the White Nile to the west coast and eastwards to the Indian Ocean. The sand-banks of the Nile and other rivers, and the shores of lakes and swamps form the haunts of this species, which lives in pairs, but whose habits are scarcely known. A more familiar bird is the African adjutant or marabout stork (*Leptoptilus crumeniferus*), a species considerably larger than the European white stork, and mainly inhabiting tropical Africa, although also a common inhabitant of the upper Nile valley.

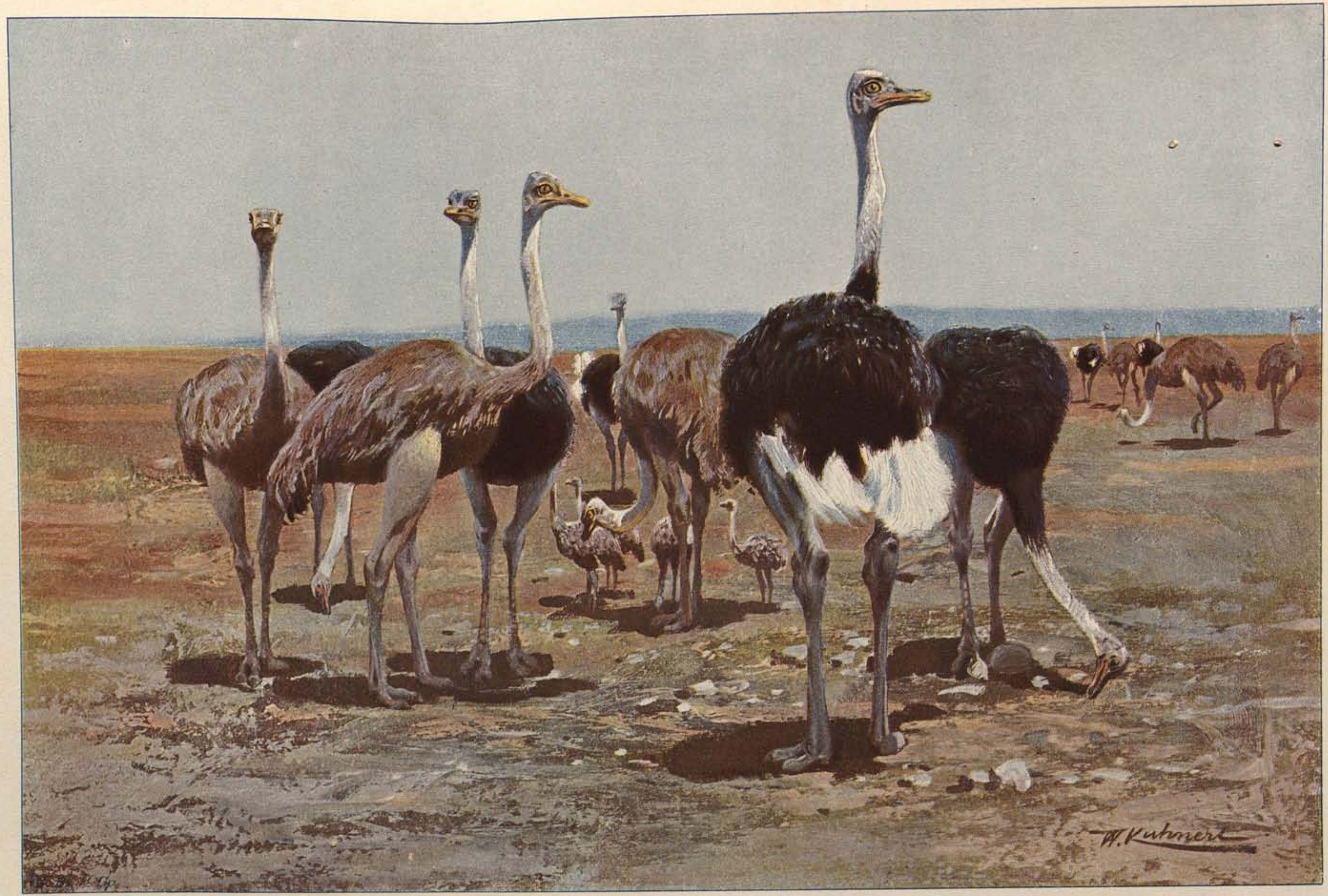
Ibis. Symbolical of Egypt is the sacred ibis (*Ibis æthiopica*), which breeds on the upper Nile, in Nubia, the Sudan, and Abyssinia, and ranges so far south as Cape Colony, where, however, it is rare. In ancient times this ibis may have been a native of lower Egypt, where it was found by the Romans when they conquered the Delta, and by them introduced into Italy. It is, however, possible that the ancient Egyptians, who worshipped it as the bird of Thoth, and kept its mummies in their temples, may have introduced this sacred bird from the shores of the Red Sea, and that with the fall of the Pharaohs it disappeared from the country. Like the rest of its tribe, the sacred ibis has a bare head and neck, which are black, as are also the beak and feet. The plumage, on the other hand, is pure white, except for the black shimmering greenish tips to the wings, and the violet-black edges of the shoulder-feathers. This bird, whose flesh, on account of its fishy taste, is not eaten by Europeans, lives on the molluscs, insects, crabs, and worms which it finds on the banks of rivers and lakes.

Sand-Grouse, Bustards, and Waders. Among other European and Asiatic types, the sand-grouse are represented in northern Africa by the pin-tailed *Pteroclurus exustus* and the close-barred species, *Pterocles lichtensteini*. The south European, or Andalucian, bustard-quail (*Turnix sylvatica*) is likewise a by no means uncommon species in our area. In the rail group we have the crested coot (*Fulica cristata*), a species distinguished from its common European relative by the presence of a pair of red fleshy knobs above the white shield on the forehead. In addition to the true European bustard (*Otis tarda*) and the little bustard (*O. tetrax*), there is an indigenous species in the shape of the African ruffed bustard (*Hubara undulata*), whose range extends from the Canaries through northern Africa about as far east as Armenia. This species, which occasionally visits southern Europe, differs from the hubara bustard (*H. macqueeni*) not only by its somewhat superior dimensions, but by the possession of a crest of long white feathers. None of the foregoing generic types is met with in Ethiopian Africa.



BLACK-BACKED COURSER.

A specially interesting species is the black-backed courser, or, as it is often called, black-headed plover (*Pluvianus ægyptius*); a bird so well concealed by its coloration that at a short distance only three independent patches of grey are visible. The crown and cheeks are black; above the eyes is a black band which is continued round the nape; the beak is black and the throat white, while the under-parts are cream-coloured, and the tail and wings grey, with a black bar and a white tip to the former, and the quills of the latter white with a black band and tips. This bird has not only the remarkable habit of picking out leeches and the grubs of flies from between the teeth of the open jaws of crocodiles as they lie like logs



SOMALI OSTRICH.

basking on the sandbanks of the Nile, but is also believed by the natives to warn these sluggish saurians of impending danger. In the time of Herodotus, by whom it was first described, the black-backed courser was already a familiar bird, well known by the name of *trochilus*, a name now transferred to the humming-birds. Its eggs are buried by the female in the heated sand of the banks of the Nile, where they are in due course hatched by the sun's rays. It is stated that the bird keeps them moist by first wetting her wings in the river, and then drying them above the spot where the clutch is laid. During incubation the eggs become much bleached.

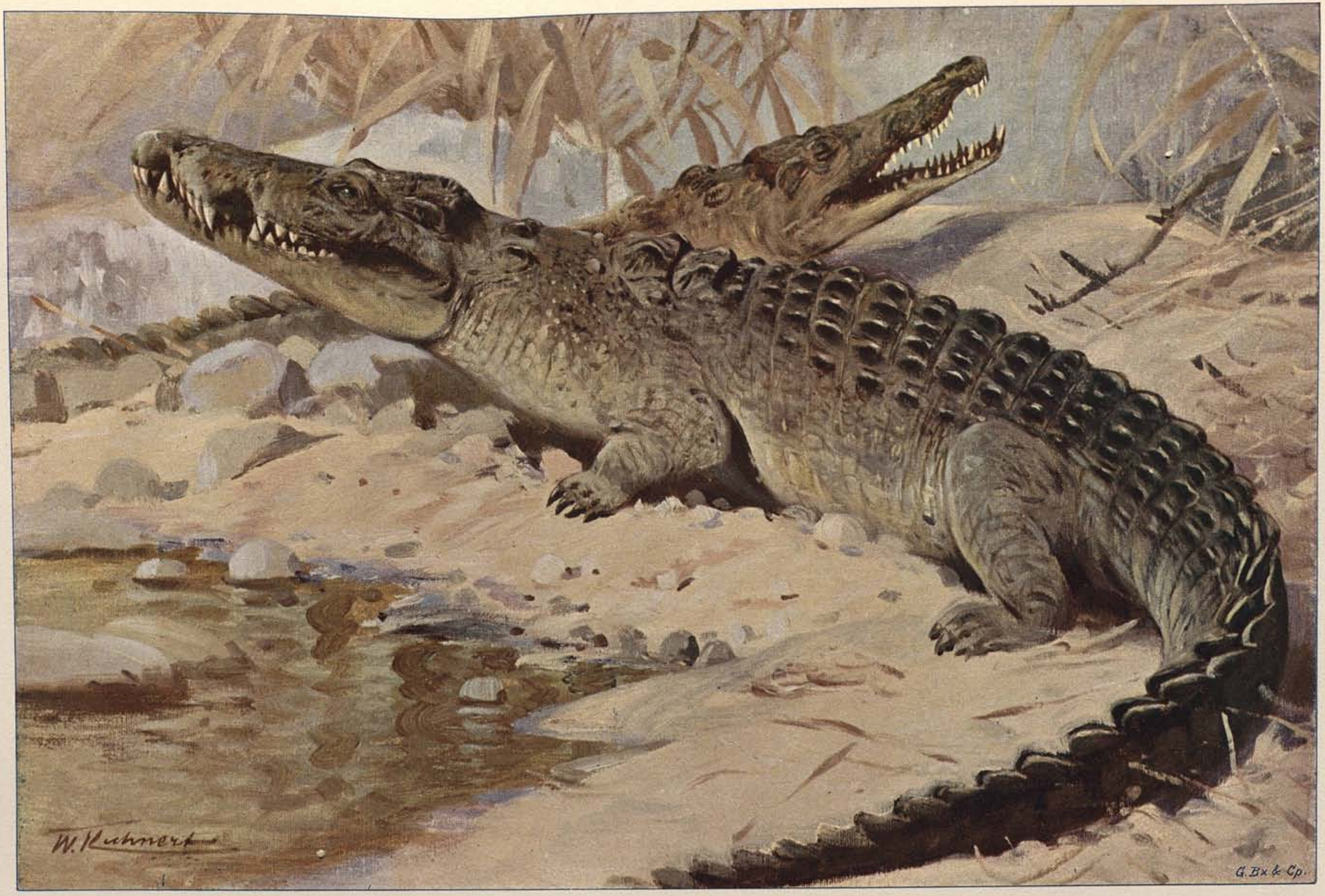
Water-Birds. Another bird known to Herodotus is the handsome but ill-flavoured Egyptian goose (*Chenalopex ægyptiaca*), which ranges over the greater part of tropical Africa, and is likewise the common wild goose of Cape Colony. This bird was tamed by the ancient Egyptians, and although not regarded as exactly sacred, was dedicated to Set, the father of Osiris. Found alike on the rivers as well as on lakes and pools, it nests either in swamps, on dry ground, on ledges of cliffs, or in trees. When flying, the gander utters a loud, harsh, rattling sound, produced in a bony capsule on the left side of the wind-pipe. Together with a South American species, this goose differs from the typical geese by its habit of breeding in trees. In size it is rather smaller than an ordinary wild goose; while in colour it is pale yellowish brown, passing into rusty brown above, and marked with thin wavy lines. The face and a spot on the breast are dark reddish brown, the wings, with a green and violet reflection, have a large white patch in the middle, the face is black, and the feet and beak are red.

Ostrich. In former days ostriches (*Struthio camelus*), belonging to the typical northern species, or race, which lays eggs with smooth and polished shells, abounded in the deserts of Algeria and other districts of northern Africa, and so recently as the conquest of Algeria by the French there existed numerous troops of these birds, which visited the oasis in the neighbourhood of Tell. They resorted to that spot not only to feed, but also to dust themselves in hollows protected from the wind, where the water of the winter rains accumulates, and where sufficient moisture remains in summer to produce a considerable growth of shrubs, especially pistachios, on the nuts of which the ostriches mainly subsisted. Gradually the birds retreated southward of the high plateaus to the desert, on account of being hunted by the officers of the Arab troops and the natives. It thus eventually became necessary to travel scores of miles to the south of In Salah and into Mauritania before encountering the remaining troops of these birds. That ostriches were formerly numerous in these regions is attested by the fact that the Arabs have distinctive names for the two sexes, and likewise for birds of different ages. The natives were accustomed to capture them by fixing snares on the pistachio-bushes, or by shooting them as they came to pick up the nuts; but the favourite method was to hunt them on horseback, although, in spite of the speed and endurance of the Arab horses, success was only ensured by slipping slughi greyhounds to harass the birds and bar their return to their nests, or by having relays of horsemen. About the year 1850 seventy-two ostriches, of which thirty were cocks, were killed during eight hunts in the first year, but in 1852 only five were killed in one hunt. By 1857 the authorities were seriously concerned at the scarcity of ostriches, and steps were taken to recruit their numbers. These, however, did not prove successful; but an attempt to retrieve this lack of success was made in 1908 by the Algerian Government, who decided to establish a farm in the district of Jebel Nador, about 135 kilometres south of Tiaret, where wild ostriches were formerly numerous. As none were obtainable in the neighbourhood, five ostriches were bought in Abyssinia and transported to the park, where they arrived safely; but unfortunately the experiment has hitherto proved practically a failure.

Soft Tortoise. While so many of the North African mammals and birds are of a South European type, a large proportion of the reptiles have no representatives in Europe. The curious soft river-tortoise (*Trionyx triunguis*) is one of these non-European types, which belongs to a widely spread genus and family, and also occurs in western Africa. When the head and neck are protruded this tortoise measures about a yard in length from muzzle to tail-tip. In colour it is greenish or brownish above, ornamented with white spots, and dull white beneath. It is known to the Arabs as tirsen; and its flesh is edible. As its American relative devours young alligators, so the African species feeds on baby crocodiles as they issue from the egg; also consuming water-fowl, frogs, insects, and other creatures.

Crocodile. Northern Africa is the home of the typical and longest-known member of the crocodilian order, the *timsa* of the Egyptians, and the Nile crocodile (*Crocodilus niloticus*) of naturalists. This species, which is now unknown to the northward of Thebes, occurs not only in the Nile, but in the rivers of East and South Africa, as well as in Madagascar. Even in the upper Nile the crocodile nowadays seldom exceeds 18 feet in length, although a few reach 20 or even more feet. Some individuals have broader muzzles than others, and the form of the whole head shows such a remarkable difference that there would at first sight seem to be two distinct races of the species. Specimens are, however, met with which completely bridge over the difference between the extreme types.

In the Atbara River and the Blue Nile, crocodiles attack not only domesticated animals, such as goats, sheep, and dogs when they come down to drink, but also natives who may be bathing in or fetching water from the river. On such occasions these reptiles approach the shore by drifting slowly on the surface of the water, when they look like the trunks of old trees; no sooner, however, are they sufficiently close than they suddenly rise, knock down their victims with a blow of their tails or by a snap of their huge jaws, and then drag them into deep water. One instance is related, supported by photographs of the actual scene, where a rhinoceros, while crossing a river in East Africa, was seized by one hind-leg by a crocodile and after a somewhat protracted struggle eventually drawn backwards into the water and drowned. After death the prey is dragged to some other part of the shore to be devoured at leisure. In Sennar, the women who fetch water are in the habit of beating the surface of the river with sticks, and keep constantly on the look-out, for the slightest carelessness may be fatal, as a crocodile may swim up unnoticed under the surface of the water, and measure the distance so exactly that it will seize one of the party at the first attempt. On one occasion an English traveller watched an unusually large crocodile lying immovable like a log between



NILE CROCODILE.

some rocks, which it closely resembled in colouring. Close by was a drinking-place frequented by baboons. Towards evening a troop of these animals cautiously approached the river; but it was not until they were quite close to their lurking enemies that one of the younger members of the party became aware of the danger. With loud screams this young baboon sought safety in a tree, of which it shook the branches violently in order to make a noise and thus cause the crocodile to move and betray its presence. The other baboons joined in the attempt, but without success, for as the sun set the crocodile still lay like a harmless log or rock in the river.

After an unsuccessful attack on a flock of birds a crocodile will not unfrequently swim some distance down-stream with its muzzle just above the surface till the unsuspecting birds come once more to drink, when there is a sudden splash in the water, an enormous head rises to the surface, and a pair of huge jaws open and close upon perhaps half a dozen victims. In order that their cattle may drink in safety, herdsmen construct fences around certain shallow places near the banks, which the crocodiles do not venture to climb when a man is on guard behind.

Much has been written about the awkwardness of crocodiles on land, but this is mainly due to incorrect observations, and based on the erroneous idea that these reptiles have stiff necks which they cannot bend. As a matter of fact, a crocodile on land, if undisturbed, moves quietly and easily in a lizard-like fashion; and when startled is extremely quick in turning. Crocodiles are possessed of a kind of wandering instinct, and sometimes travel from one place to another miles away, for some reason not yet known. In such cases these reptiles often climb fairly steep banks, and apparently travel across country during the night.

At the approach of danger crocodiles instantly retreat to the water, and are rarely surprised on shore. On land they will attack only while watching their eggs, at which times the female will rush furiously at intruders. In the water they generally avoid a combat by diving.

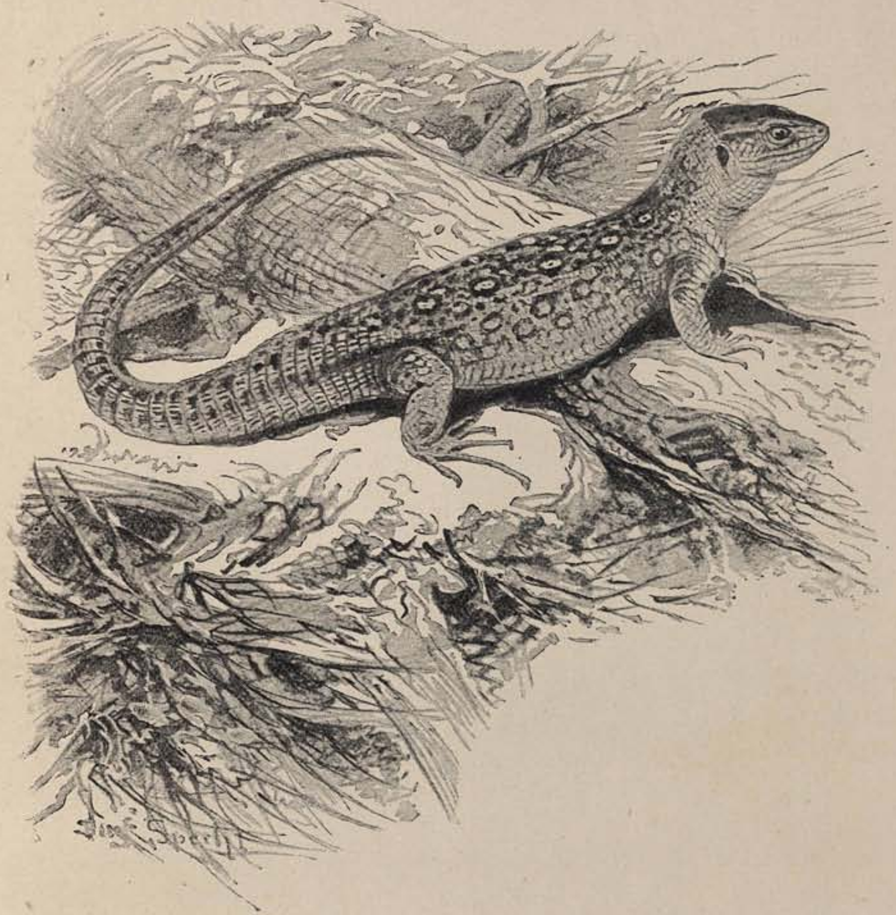
When the Nile is low, hippopotamus-shooting is finished and the cool season has set in, crocodile-hunting commences, for at this time these reptiles sleep on the islands, where the females watch over their eggs, which are deeply buried in the sand. As soon as a native hunter has discovered the haunt of a crocodile, he digs a hole and heaps up the sand on the side of the island where the creature has been last seen; and in this hole he hides when the crocodile creeps to its favourite spot, where it soon falls asleep in the heat of the sun. Immediately the watcher steals quietly up, and thrusts a spear into the reptile's body between the legs. The spear, or harpoon, is not heavy, and is fastened to a cord at the other end of which is a block of wood to serve as a float. The line consists of forty or fifty thin loose strands in order to prevent its being bitten through, and to allow it to slip into the gaps between the teeth of the crocodile. The hunter follows the float as it swims on the water, and tries to guide the crocodile close to the shore by pulling at the rope. Other men join in the pursuit and use their harpoons until finally the reptile is dragged on to the sand, where, if it is intended to keep it alive, its jaws are tied together, its legs strapped to its back, and an iron ring driven through its nose.

In the following passage an English traveller describes crocodile-hunting on the Setit:—A crocodile was observed lying on a sand-bank close to a bed of reeds, whereupon two natives who had found out the position of the reptile went a short way up the river, and swam across harpoon in hand. On reaching the opposite shore, they waded and swam down to the spot where the crocodile lay. Where the high bank did not afford shelter and they found water enough, they swam softly with the current, and crept over the shallow places, until they reached the reeds on the other side of which the reptile lay asleep. Standing in the water up to the chest, they slowly advanced through the reeds towards their prey, holding up their harpoons, in order to be able to hurl them when necessary. When scarcely eight paces away they were scented by the reptile, which dropped into the water, carrying with it the harpoons. The iron head forthwith became detached from the bamboo-shaft and remained fast in the flesh of the crocodile; while the float, which was made of light wood, swam on the surface and indicated the course which the reptile, now left to itself, took beneath the water.

On the sand-spits of the Blue Nile a dozen or more crocodiles may often be seen basking in the sun; and in West Africa, more than a couple of hundred are said to have been seen at a time. The female is reported to lay about a score of eggs, two or three times a year, the first clutch being deposited at the beginning of summer. These are buried in the mud on the shore, where they are hatched by the heat of the sun. A musky fat secreted by certain glands in the skin of the crocodile is used by the natives as a pomade. The skin of the back, which is studded with bony plates, is used for shields, the thinner skin of the under-parts is made into sandals and dagger-cases, the teeth are preserved as ornaments, and the flesh, which is stated to bear a certain resemblance to that of sturgeon, is eaten by some of the North African natives.

It is very difficult to obtain trustworthy information with regard to the maximum dimensions of crocodiles of any kind, and this is more especially so in the case of *Crocodilus niloticus*. Those who shoot these reptiles seldom take the trouble to measure such as are brought to land. That Indian crocodiles commonly attain a length of from 15 to 20 feet is well known, while, as stated on page 207 of the second volume, they sometimes grow to a much greater size. It has been stated, for instance, that both of the two Indian species, *C. porosus* and *C. palustris*, may grow to 30 feet, and there is in the British Museum a skull of the first-named species killed in Bengal in 1840, which was stated by the donor to have belonged to a reptile measuring 33 feet in length. On the other hand, there does not appear to be any record of the African crocodile attaining anything approaching such dimensions. The largest specimen of this species in the British Museum measures just under 15 feet (4½ metres) in length; and in Madagascar the largest specimen hitherto measured was 13 feet long. It appears, indeed, that there is no authentic record of any specimen exceeding 17 feet in length, and in South Africa a 13-foot crocodile is regarded as a large one. So far as can be ascertained there appears to be no record of an African crocodile 22 feet in length.

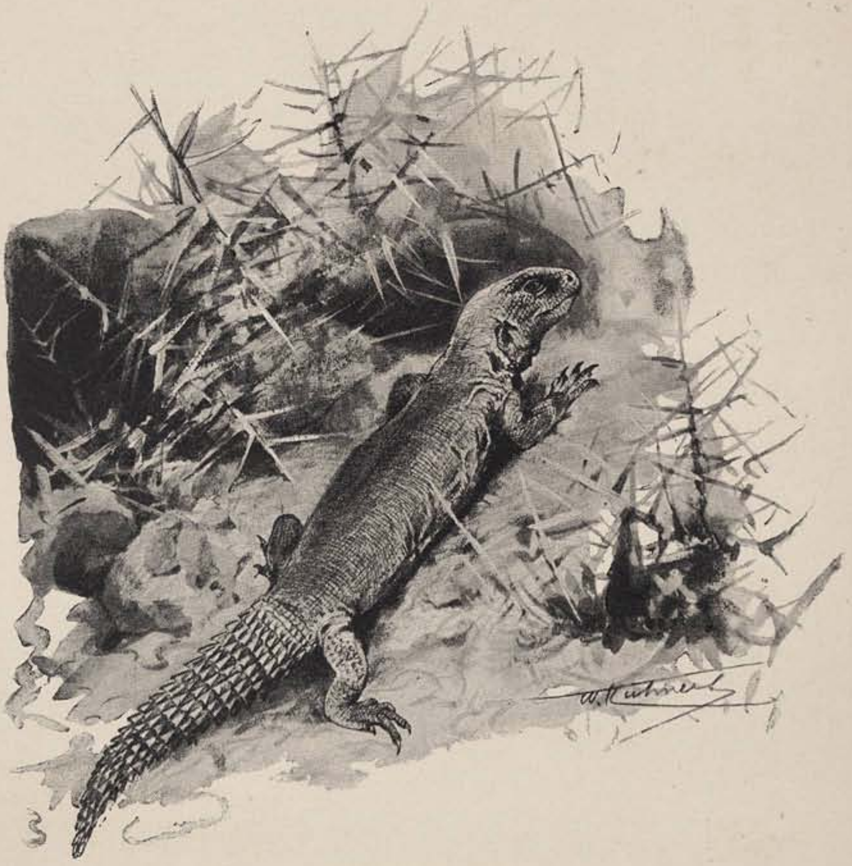
Monitor. One of the enemies of the crocodile is the large North African lizard generally known to the English in the country as the iguana, but termed by naturalists the Egyptian monitor (*Varanus niloticus*). Attaining a length of from 5 to 7 feet, and having a sharp keel along the upper side of the tail, this monitor is mainly dark brown in colour with darker mottling and light olive-green or yellowish spots. When walking, it straddles its legs far apart, and turns its long neck and head from side to side, continually darting out its long, forked tongue at short intervals with great rapidity. On land the movements of monitors are comparatively rapid, and in water these reptiles swim and dive with wonderful quickness and perseverance, being apparently able to remain a long time beneath the surface without breathing.



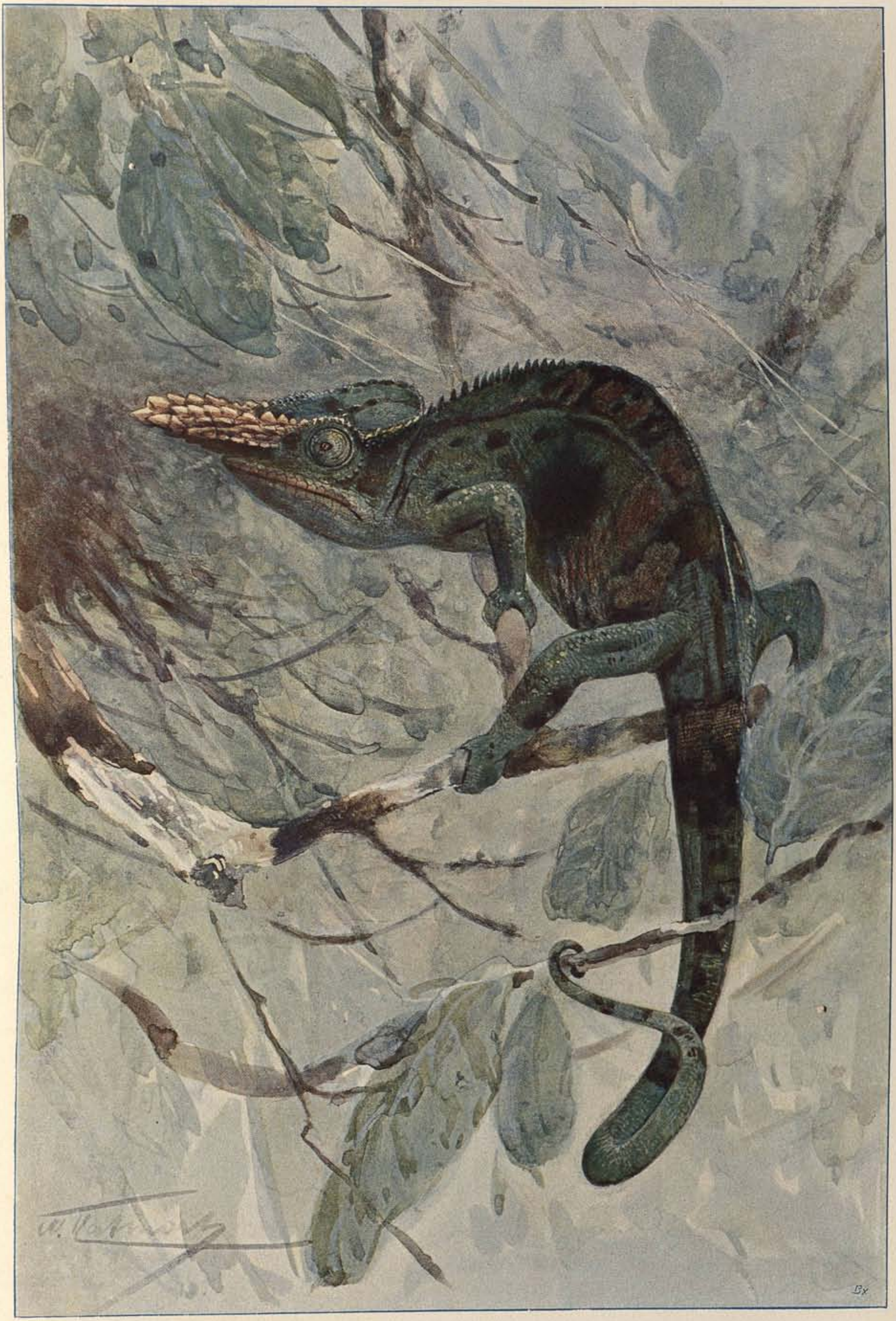
PEARLY LIZARD.

Monitors feed on fishes and their spawn, the eggs and young of crocodiles, frogs, water-beetles, dragon-flies and other insects, as well as on birds and small mammals. They climb fences to steal domesticated pigeons and fowls; but although spiteful in disposition, they have not teeth strong enough to enable them to inflict serious wounds on human beings. Although these reptiles will occasionally remain for some time in districts far away from water, they always return sooner or later to its neighbourhood. Very different, on the other hand, are the habits of the desert monitor (*V. griseus*) of the deserts of northern Africa, which differs from the Egyptian species by its light brown colour and the absence of a keel on its cylindrical tail. This reptile, which is the land-crocodile of Herodotus, measures about one yard in length; and its food comprises jerboas, birds, small reptiles, and locusts and other insects. The native jugglers carry it about with them for use in their performances.

Other Lizards and Geckos. Another lizard inhabiting northern Africa, and found in the Iberian Peninsula and southern France, is the pearly lizard (*Lacerta ocellata*), which grows to more than a couple of feet in length and feeds on insects, mice, small snakes, and lizards and frogs. Its Latin name is derived from the black, eye-like spots with greenish yellow centres dotted over the brownish grey or greyish green body. The skink (*Scincus officinalis*), formerly so much used in medicine, is another North African lizard, in which the colour is greyish yellow striped with lilac above, and uniformly dull green beneath. An inhabitant of arid districts, when in danger it quickly burrows in the sand. Much larger than the skink is the Arabian spiny-tailed lizard (*Uromastix spinipes*), which subsists exclusively on vegetable food and is confined to dry districts, where it also burrows in the sand. It belongs to a different family (*Agamidæ*) from the skink group, and takes its name from the rings of spines encircling the segments of its long tail. Lizards of the same genus range through Syria and Arabia to the desert districts of northern India. Of quite a different type is the wall-gecko (*Tarentola*



SPINY-TAILED LIZARD.

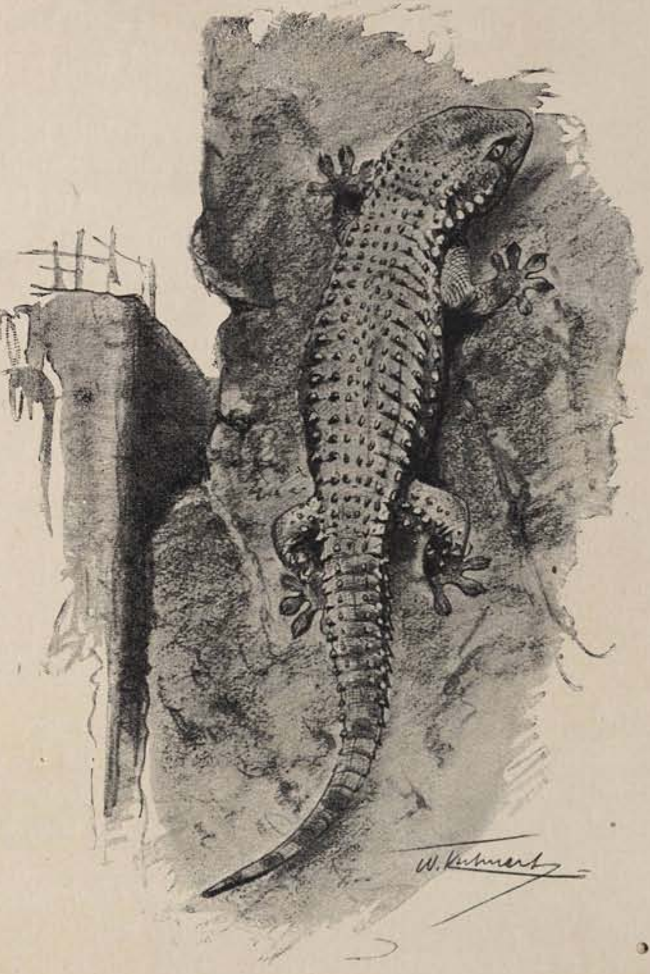


AFRICAN CHAMELEON.

mauritanica), a species, also found in southern Europe, which attains a length of about 6 inches, and is grey or brownish black in colour, marked with obscure dark spots. It is one of the best known representatives of the gecko family, and may frequently be seen searching for food at night on walls and ceilings, to which it clings by the sucker-like discs at the tips of its toes.

Chamæleons.

The remarkable group of arboreal lizards known as chamæleons, whose headquarters are Africa, have several representatives in the northern part of that continent. In addition to their well-known power of changing their colour in order to harmonise with their surroundings, these reptiles are characterised by the peculiar structure of their eyes, feet, and tongue, while their remarkable form and slow movements render them unmistakable. The North African species include the common chamæleon (*Chamæleon vulgaris*), of the Mediterranean coasts of Africa and Asia and the south of Spain, *C. calyptratus* of the Nile valley, and *C. basiliscus* of Egypt and Syria. Chamæleons lay in shallow hollows scratched in the ground from 30 to 40 round eggs, which they cover with earth and leaves. The slow movements of chamæleons are familiar to all, as is also the curious manner in which they grasp boughs, with two toes on one side and two on the other. In contrast to their slow-moving limbs is the lightning-like rapidity with which the tongue is shot out, as if from a spring, to capture the flies on which these reptiles feed.



WALL-GECKO.

Snakes.

One of the most dreaded of North African snakes is the horned viper (*Cerastes cornutus*), a species about 2 feet in length which lurks in ambush for its victims coiled up in the sand, with which it harmonises almost exactly in colour. It derives its name from the pair of horn-like processes above the nose. Even more dangerous than the horned viper, and also considerably larger, is the asp, or Egyptian cobra (*Naia haie*), which attains a length of from

4 to 7 feet, and, like its Indian cousin, defends itself by raising the fore half of the body from the ground, and puffing out the neck previous to striking. It lacks the spectacle-like markings on the head characteristic of the Indian species. The Egyptian jugglers employ this reptile in their performances, after rendering it harmless by the extraction of the poison-fangs. Another desert species is the lizard-snake (*Cœlopeltis monspessulana*), whose range includes the borders of the Mediterranean, whence it extends eastwards to the Caucasus and Persia. This snake, which feeds on lizards, birds, and mice, grows to a length of from 3 to 4 feet, and is greenish brown, greyish yellow, or tawny above, with or without black spots, and yellowish white, often spotted with black, below.

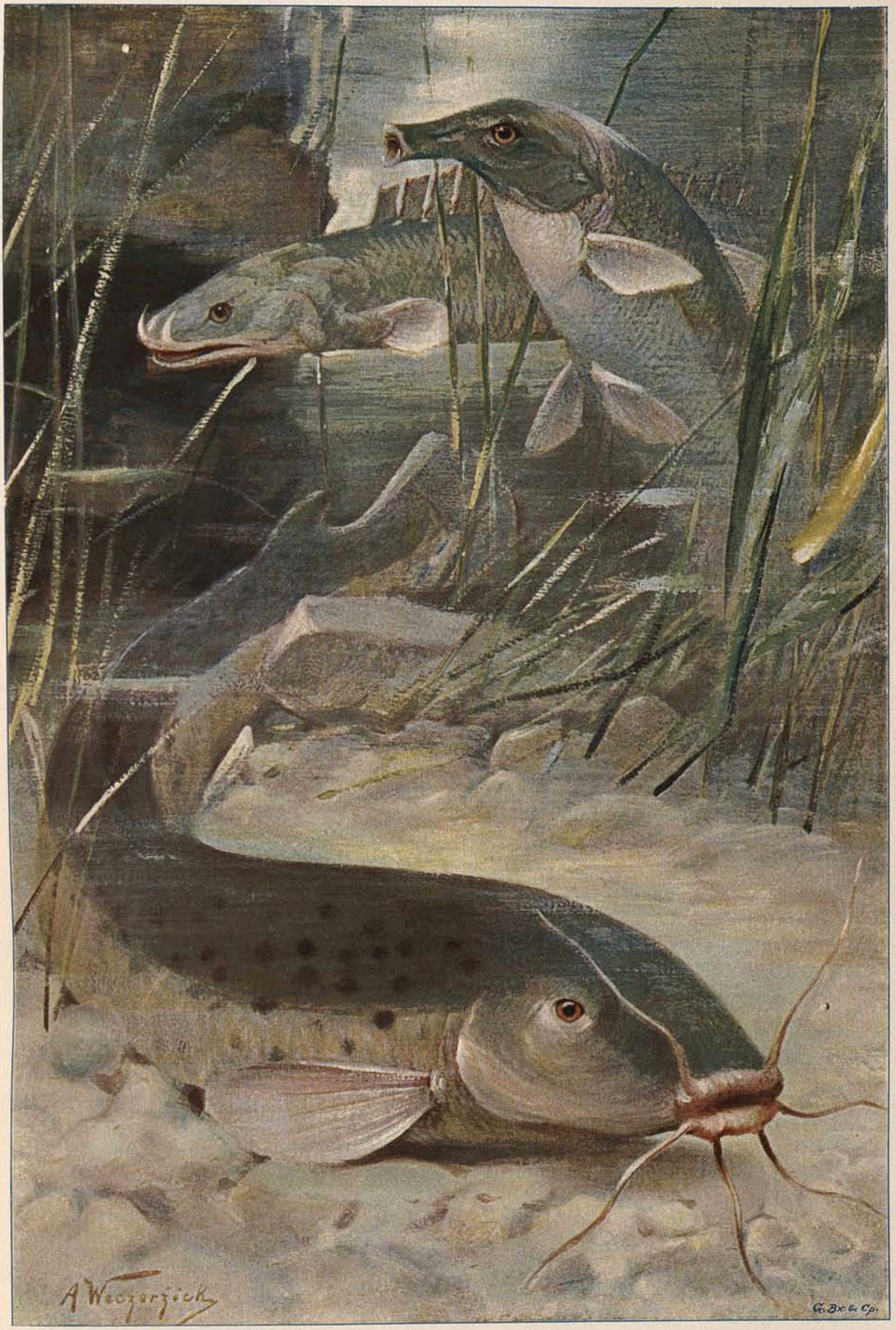
Fishes.

Nothing need be stated with regard to the amphibians of North Africa, seeing that there are no specially remarkable species, but the fishes are of greater interest, although mainly belonging to tropical types, and not therefore characteristic of the district under consideration. Among the *Siluridæ*, the electric cat-fish (*Malapterurus electricus*) of the Nile is remarkable for possessing, like the electric eel of North America, an electrical organ which occupies the whole length of the body. The numerous representatives of the toothed carps (*Cyprinodontidæ*) of Africa include *Cyprinodon calaritanus*, which is indigenous to the northern districts of the southern continent and also to the south of Europe. The females of this fish are 3 inches long, while the males measure only 2 inches. The species is one of a dozen members of a group, of which seven are indigenous to the Mediterranean area, and inhabits not only estuaries but salt-lakes and salt-springs. The curious beaked fish of the Nile (*Mormyrus oxyrhynchus*), which grows to about a yard in length, and was held sacred by the ancient Egyptians, by whom it was often represented in their frescoes, is the northern representative of a numerous family group (*Mormyridæ*) exclusively confined to Africa. These fishes take their name from the trunk-like prolongation of the muzzle, which is used for probing in the mud in search of food. They are more fully referred to in the sequel.

Very noticeable is the occurrence in the Nile and some of the rivers of West Africa of the fahaka (*Tetrodon fahaca*), a representative of the globe-fishes, the great majority of which are marine. Like its kindred, this fish, which grows to a length of from 12 to 18 inches, has the greater part of its body covered with slender spines, and can inflate itself to an enormous size, when it is, of course, compelled to float on the surface.

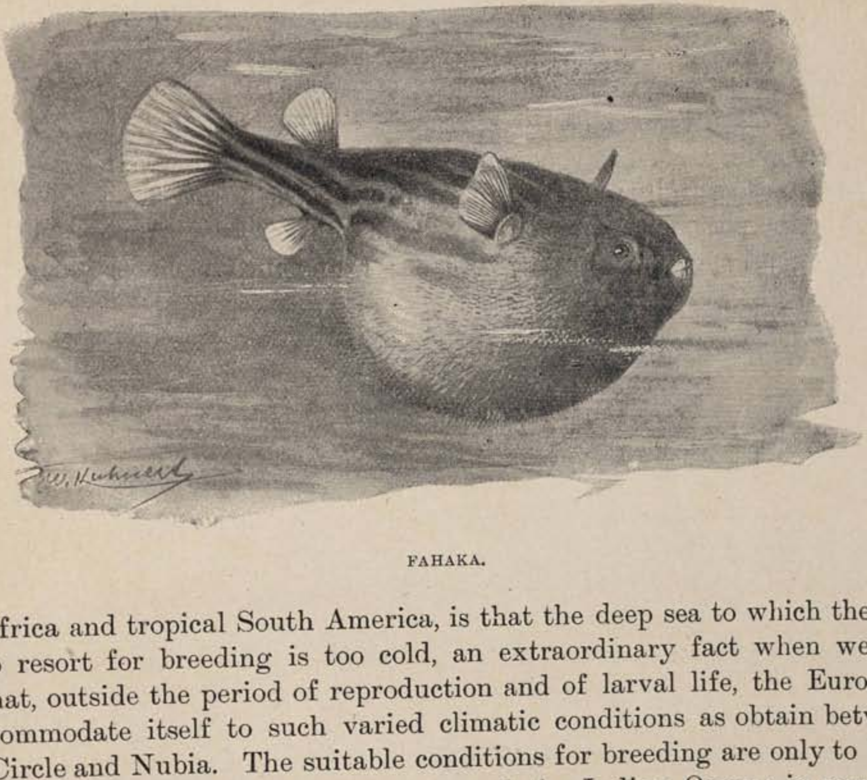
More remarkable still is the bichir (*Polypterus bichir*), which inhabits both the West African rivers and the Nile, although rare in the middle and lower parts of the course of that river. This fish, which grows to about 4 feet in length, is one of two generic types (both African) which at the present day represent the very ancient and once abundant group of so-called fringe-finned ganoids. The body is clothed in an armour of polished bony scales, and the fins consist of a central cartilaginous axis from which diverge the rays. The generic name is derived from the circumstance that the back-fin is broken up into a number of finlets, each with a spine in front.

Since eels are for the greater part of their existence fresh-water fishes, the species inhabiting northern Africa, as well as those of the rest of the continent, may be mentioned in this place. Although our knowledge of African eels is still



ELECTRIC CATFISH. BICHIR. TRUNKFISH.

imperfect, there appear to be four species, of which the one inhabiting North Africa, and likewise Madeira and the Canaries, is identical with the European *Anguilla vulgaris.* In East and South Africa are found *A. mossambica*, *A. bengalensis*, and *A. bicolor*, the range of all of which extends to the South Pacific. Of these, *A. mossambica*, ranging from the Cape to Zanzibar and the Seychelles, comes nearest to the European species, from which it differs by the broader bands of teeth. Strange to say, however, there are no eels in tropical West Africa, this being accounted for by Dr. J. Schmidt, of the Danish Fishery Commission, who, with the aid of hydrographers, has ascertained that the water of the great depths of the inter-tropical Atlantic is for the greater part between 4° and 5° C., nowhere reaching the temperature ascertained to be the minimum (7° at a depth of 1000 metres) required for the breeding of the eel in the North Atlantic. "Therefore the reason why eels are absent from some of the warmest regions of the world, such as West Africa and tropical South America, is that the deep sea to which they would have to resort for breeding is too cold, an extraordinary fact when we bear in mind that, outside the period of reproduction and of larval life, the European eel can accommodate itself to such varied climatic conditions as obtain between the Arctic Circle and Nubia. The suitable conditions for breeding are only to be found in the North Atlantic, the Mediterranean, and the Indian Ocean; in consequence, eels are only found in those parts of Africa (North, East, South) which are within the migratory powers of the fish."

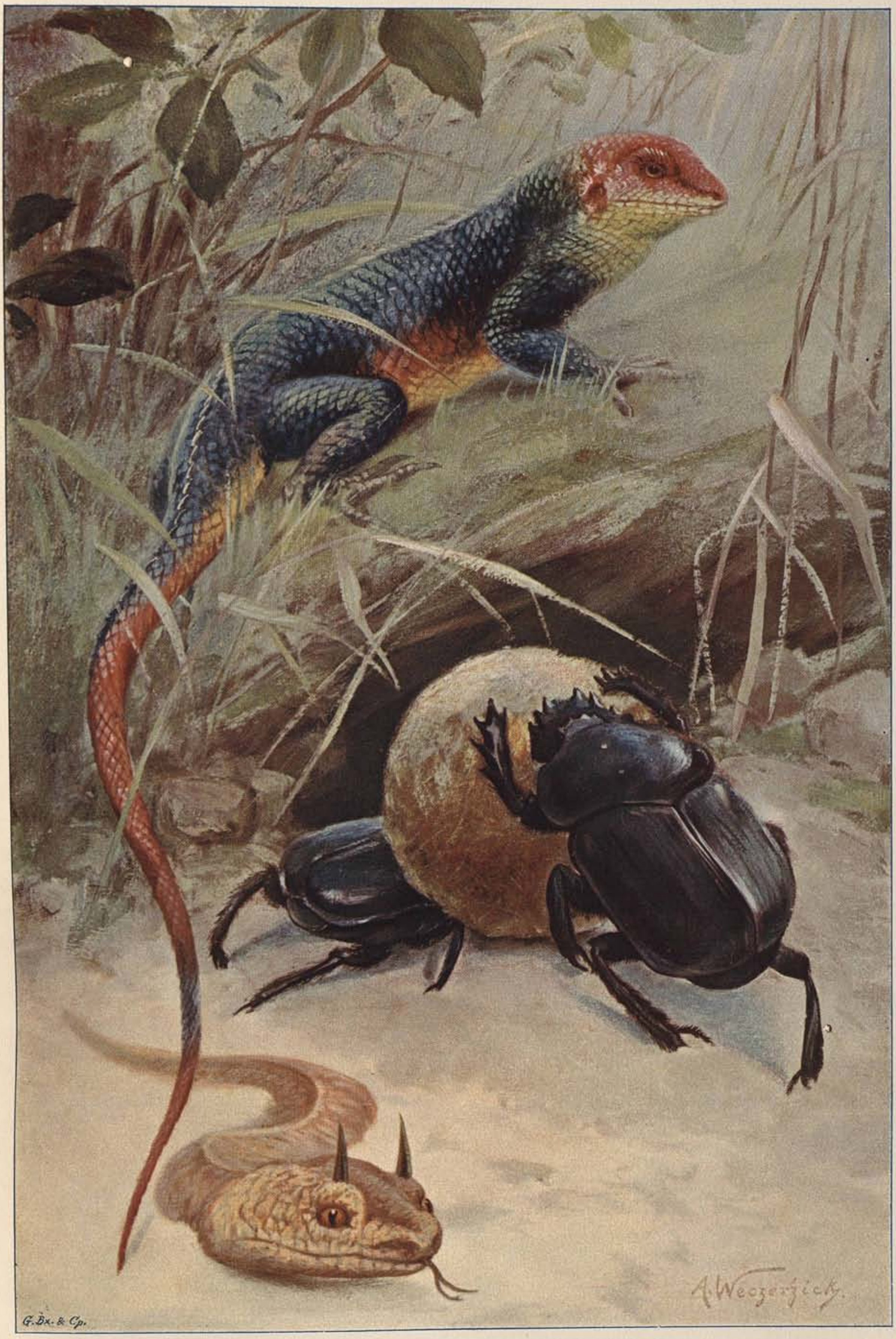


FAHAKA.

Scarab Beetle. The most celebrated of the insects of northern Africa is the scarab beetle (*Scarabæus sacer*), a black burrowing species of about an inch in length, held sacred by the ancient Egyptians, and frequently represented in their frescoes and sculptures, sometimes on a gigantic scale. It belongs to a numerous Mediterranean group, and is itself common to southern Europe and south-western Asia as well as to northern Africa. This beetle makes up small balls of manure, each of which receives an egg, and is then rolled to some suitable spot by means of the hind-legs of the beetle, where it is buried in the ground. In due course the grub emerges from the egg, to find an adequate supply of nutriment in the enveloping ball.

Scorpions. North Africa, in common with the other Mediterranean countries, abounds in scorpions. In addition to the sting at the tip of the tail, these creatures are provided with a powerful pair of nippers on the first pair of appendages, and they also possess two comb-shaped structures on the abdomen, the function of which is unknown, although they probably serve as feelers. Scorpions produce living young, which are carried about by their parents for some time. They are represented by about two hundred species distributed over the warmer regions of the globe. Scorpions remain in concealment during the day, to issue forth at twilight and at night for their prey, which consists chiefly of spiders and insects. The Mauritanian scorpion (*Scorpio maurus*) is a well-known North African representative of the group.

All the numerous kinds of scorpions are predaceous in their habits; and all produce their young alive, these being carried for a time on the backs of the females. The prey, which consists chiefly of insects and spiders, is seized by the large "pincers," and if of small size is torn up by the appendages, which fulfil the part of jaws, and eaten. When, however, a large insect or spider is seized, the sting at the tip of the tail is brought into play, and the unfortunate victim quickly paralysed by the poisonous secretion. A scorpion takes a long time over its meals; neither does a prolonged fast appear to cause it any inconvenience. Touch seems to be the sense on which scorpions chiefly rely.



AGAMA, HORNED VIPER AND SACRED BEETLE.

AFRICAN CIVET-CAT.

CHAPTER III

THE MAMMALS OF ETHIOPIAN AFRICA

In the course of the preceding chapter it has been incidentally mentioned that for zoological purposes it is convenient to designate the whole of that portion of the continent lying south of the northern tropic as Ethiopian Africa. Ethiopian Africa, together with the south of Arabia, forms indeed a distinct zoological region, whose fauna presents a most remarkable difference from that of northern Africa and the other Mediterranean countries. Except where a few of them have entered it to a certain extent along the course of the Nile, we note in the Ethiopian region the complete absence of wolves, bears, deer, wild goats, wild sheep, wild cattle (other than buffaloes), and true wild horses and wild swine. On the other hand, we here — and here only — meet with gorillas, chimpanzis, guereza monkeys, galagos, hunting-dogs, aard-wolves, spotted hyænas, giraffes, okapis, elands, gnus, hartebeests (of which, like the oryx group, one species has effected an entrance into northern Africa), gemsbuck and other oryx, sable antelope, klipspringer, duikerbok, and a host of other peculiar types of antelopes, together with hippopotamuses, wart-hogs, bush-pigs, forest-hogs, zebras and quaggas, smooth-skinned rhinoceroses, tree-hyraxes, lozenge-toothed elephants, ant-bears, and secretary-birds. If smaller forms were included, such as the golden moles and the curious otter-shrews, the list might be almost indefinitely extended, but the animals here mentioned are amply sufficient to emphasise the vast distinction between the fauna of Ethiopian Africa and that of not only the Mediterranean countries but of the rest of the world.

The nearest relations of the Ethiopian fauna appear to be with the later extinct faunas of India; and there seems a considerable probability that the ancestors of many of the types of animals now characteristic of Africa south of the Sahara were immigrants from Hindustan, although, as already mentioned, the elephant group and the hyraxes appear to have originated in Africa itself.

Madagascar, it may here be mentioned, forms a zoological region by itself, and is therefore discussed in a separate chapter.

The physical characters of the country vary greatly in different parts of the Ethiopian region. In the southern extremity we have a comparatively small tract with forests of evergreen trees, adjoining which is the desert area of the south-west of the continent. On the east coast, commencing a little north of Mozambique and extending to 2° S. latitude, runs a narrow strip of not very rich tropical forest. The really luxuriant tropical forests of vast extent—the true equatorial forest-zone, and the home of the gorilla, the chimpanzi, the bongo, and the okapi—commence, however, on the coasts of the Cameruns and Liberia and at the mouths of the Congo and Niger, whence they extend eastwards across the heart of the continent to the valleys of the Ituri and the Semliki and the southern border of the Bahr-el-Ghazal province. Kordofan, Abyssinia, and Somaliland form a semi-desert tract of thorn-bushes. The greater portion of the continent, from the Sahara to the Cape, consists, however, of more or less open country—typified by the *veldt* of the Transvaal—forming the largest extent of this type of country on the globe.

Of the West African primeval forest, the Loango coast affords a typical example; this forest-tract, in its most fully developed form, covering the heights and slopes of the mountains, the lowlands below, and many of the river-valleys. The beauty of this forest is due, however, not to that great variety of vegetable life so distinctive of the Brazilian forests, but to the enormous numbers of a few kinds of gigantic trees, which communicate to the forest an astonishing uniformity, and form a kind of green vaulted roof, supported by innumerable towering stems 70 feet or more in height. Of these lofty columns, some are thick, straight, and cylindrical, without branches, while others are bent, gnarled, and much branched, terminating in loose masses of foliage, in many places intertwined by luxuriant creepers. Through the leafy roof the sun's rays cast quivering golden gleams into the subdued light, and brighten the greys and browns which form the prevailing tints.

Evergreen trees, with their tops intermingling, form the bulk of this mighty forest; but above the leafy roof rise giant deciduous trees which do not display their branching tops till at a height of 100 or 150 feet. The stems are mostly bare, parasitic plants being conspicuous by their absence, while even mosses are rare, and of underwood there is scarcely any. On the ground the fallen branches decay embedded in dry leaves; but where some forest-giant in its fall has made a gap in the leafy roof through which the daylight enters, young saplings appear and struggle upwards with the lower forms of plant-life already growing on the spot.

The East African forest, on the other hand, is chiefly confined to the mountain-ravines, and is neither so abundant nor so extensive as that of the west coast. It is more open, contains more trees indigenous to drier localities, and a considerable number of bushes of more or less characteristic appearance. In the south-west the forest-growth mainly consists of low, dark evergreens, which only along the coast attain their full height of from 4 to 7 feet, trees being restricted to the moist slopes and ravines of the mountains of Cape Colony. The evergreen shrubs of the southern districts have leaves even smaller than those of the Mediterranean countries, and, as a rule, inconspicuous, although thickly clustered, blossoms. With them grow countless bulbous plants, thorny bushes, and succulent vegetation, trees with pinnate leaves being rare throughout this tract.

Until the opening up and exploration of East Africa it was generally supposed that the forest districts of the west coast possessed an altogether peculiar fauna, but since that date evidence has been gradually accumulating to show that a large number of the genera of mammals long supposed to be peculiar to that area and its hinterland really range right across the forest-zone to the Semliki and Uganda. One of the first types formerly supposed to be peculiar to the western area, of which the range was shown to include the eastern side of the forest region, was the chimpanzi, which was recorded from the Niam-niam country by Schweinfurth, and later on from Monbuttu by Emin Pasha. On the other hand, the gorilla, the mandrill, and the drill still appear to be exclusively western types, although the possibility of their discovery in the east must not be overlooked. As regards other groups, specimens brought home by Major Powell-Cotton proved the existence in East Africa of the otter-shrew (*Potamogale*), the water-chevrotain (*Dorcatherium*), and the red tiger-cat; while Mr. F. W. Isaac was the first to add the bongo (*Tragelaphus euryceros*) to the eastern list. The yellow-backed duiker has been shown to extend to the Ituri and Rhodesia, and the pigmy royal antelope of Guinea is represented by a nearly allied species on the eastern side of the forest. The red Congo buffalo and the red river-hog remain, it is true, distinctly western types; but the former has an analogue in the Semliki *Bos caffer cottoni*, of which females and immature males retain the ancestral red, and bush-pigs of other species represent the red river-hog on the eastern side of the continent. Although originally discovered on the eastern side, the great black forest-hog (*Hylochœrus*) has been found in the Cameruns; and there is a possibility that the range of the okapi may extend farther west than is at present known. Amongst smaller mammals, the so-called African flying squirrels, better designated scale-tails (*Anomaluridæ*), the pigmy squirrels of the genus *Nannosciurus*, and the civets of the genus *Nandinia* have representatives on the eastern as well as on the western side of the forest tract, although the beautifully coloured *Poiana*, the African phase of the Indo-Malay linsangs (*Linsanga*), appears to be restricted to the west coast. Most important of all, from the present point of view, is the comparatively recent discovery of a potto (*Perodicticus*) in the Uganda forest.

That the greater portion of the western fauna would eventually be found to range over a large extent of the forest region was long ago predicted by Dr. A. R. Wallace, who, however, continued to apply the terms western fauna and western sub-region to the whole area and its animals. The time has now come when these terms should be replaced by the designations forest fauna and forest sub-region.

That the fauna of the forest-tract of Africa is intimately related to those of Ceylon, southern India, and the Malay countries has been long familiar to naturalists, but it is only recently that a satisfactory explanation of the fact has been suggested. This is due to Dr. Arldt, who points out that when the extinct Siwalik fauna migrated from India to Africa during later Pliocene time, probably by way of Baluchistan, Persia, and Arabia, or perhaps by a submerged line now represented by Socotra, the route must have been along a forest-tract, as otherwise animals like chimpanzis and okapis could not have formed part of the company, and of these ancient forests we have evidence in the silicified tree-trunks of the Punjab, Baluchistan, Syria, and Egypt. As the result probably of secular desiccation, the country subsequently assumed a more or less desert character, with the result that the forest animals were compelled to retreat to districts suitable to their habits; in other words, to Ceylon, Malaya, and the equatorial forests of Africa. In this way, and in this way only, can be satisfactorily explained the fact that pigmy squirrels and chevrotains are common to the African forest-region and Indo-Malaya, and that the pottos of the one tract are represented by the lorises of the other. The discovery that so many of the African types formerly supposed to be confined to the west coast really range far to the east has greatly simplified the distributional problem of the animals of Africa.

On the Loango coast two types of what is called veldt are met with; the one consisting of open, grassy plains, with sparsely distributed, flexible grasses, of not quite a man's height, which permit a view of the country. In the other type the plains are covered with closely growing, stiff, strong grasses, which make it difficult or impossible for the traveller to leave the beaten path. The main mass of vegetation in the open grassy plains consists of sweet grasses about 3 feet in average height; while the stiff grasses on the smaller plains rise to a height of as much as a dozen or even sixteen feet. The bright refreshing green of the meadows of Europe is never seen on the African veldt, even during the time of the most abundant growth of grass, because the quickly-growing grass is always mixed with dried, broken, or spear-like sprouting blades, which impart a yellowish or brownish tinge to the entire green area. Among the larger trees of the plains, the most famous and best known is the baobab, or monkey-bread tree (*Adansonia digitata*), a species restricted to the open country. Generally a well-grown tree of gigantic size, the baobab is distinguished by the disproportionate, it might even be said ungainly, thickness of the stem and branches. In shape it generally resembles a large oak, although, as a rule, it is not so gnarled and the branches are less sharply curved. The massive unbranched stem may be either as cylindrical as a column, and carry its crown of foliage at a considerable height, or may be short, and studded with knots, and dividing into a number of equal-sized branches close above the ground. In other cases the stem gives off its branches near the ground, and remains distinguishable for two-thirds the height of the tree as its principal part. During the dry season the baobab sheds its leaves, its vigorous growth being due to the soft, sappy wood, which acts as a water-reservoir.

On the eastern side of the tropical portion of the country the plains consist chiefly of grass, low shrubs, and thorn-bushes; a mimosa of some kind or other rising, with its doubly pinnate leaves, every few yards. Whether these mimosas have but one stem or branch immediately above the ground like a shrub, in all cases they grow upwards for some distance and then spread out like a mushroom, or an umbrella. Generally the trees are so far apart that an almost uninterrupted view can be obtained between them, but occasionally they give the landscape a park-like appearance. Even, however, in these park-like tracts there is no even spread of greensward, the coarse grass always growing in separate tussocks, between which is visible the bare red soil.

In South Africa during the dry season, that is to say from the beginning of May till the end of June, when the cloudless sky arches over the barren wintry landscape, and the pure dry air makes distant objects plainly visible, the plains are all one uniform monotonous grey, while the shrubs and trees are mostly leafless and bare. After the first rain of spring the moist soil is, however, covered with green in a marvellously short time, while the dark foliage of the trees stands out conspicuously against the light green of the young herbage and the pale straw-colour of the winter-grass. No shrub is more characteristic of this part of the veldt than the karu-thorn (*Acacia horrida*), with its hard white thorns, fragrant yellow blossoms, and much-divided pinnate leaves. In some places, as for instance in the dry river-beds of the karu, it develops into a tree, of which the umbrella-like crown resembles that of a Mediterranean pine. Farther north the trees of the South African veldt become taller and more numerous; but the highlands, extending from Natal westwards, are, except near the banks of the rivers, almost treeless, while yet farther west dwarf trees and shrubs preponderate, and the entire landscape gradually becomes more and more completely desert-like.

On the eastern coast the shore of the Red Sea is, at least in many parts, a semi-desert, or even a true desert; while farther south, between Kilimanjaro and the coast, deserts and semi-deserts alternate with less arid types of landscape. Among the plants of this tract are some which may almost be called monstrosities. At first the traveller meets with clumps of trees with short stems of the circumference of a man's body, and green tops formed of branches as thick as a finger but devoid of leaves. Although these euphorbias (*Euphorbia tirucalli*), as they are termed, appear to have been introduced in the coast districts and Abyssinia, they grow wild in the interior. In other districts the sandy plain is covered for miles with plants of from 2 to 5 feet in height, which grow in isolated patches, and consist mainly of other kinds of euphorbias, bearing, instead of leaves, conical hard thorns, as sharp and penetrating as needles.

In the district stretching along the western coast of South Africa between the 18th and 20th degrees of S. latitude, which, at least in the neighbourhood of the sea, has a distinctly desert character, flourish several equally remarkable plants. The region near the coast consists of ancient lofty mountains so deeply buried in sand that only their summits stand out. Thence eastwards to the Kalahari extend stony table-lands, interrupted here and there by shallow valleys, and locally known as karus. The vegetation of this tract varies according to the nature of the soil, which is either sandy, stony, or rocky. Near the coast this vegetation is but poor, such plants as manage to grow being widely separated from one another. In those places where water has collected on the surface and along the rivers in Damaraland occur thick woods, composed chiefly of acacias, certain other small trees and shrubs, and a clematis. The flora gradually changes from the coast to the edge of the desert-like veldt and woods of the Kalahari itself, partly in consequence of the varying water-supply and other conditions of the soil, and partly owing to climate. A few miles from the coast with its struggling salt-plants commences a range of hills and rocks, bearing only here and there small colonies of short-lived plants, some half-buried in the sand. On the lee-side of the rocks grows, however, a tall shrub-like plant about 5 feet in height with rod-like branches, and thick, leathery leaves, known as *Vectadium virgatum latifolium.* On the other side of the hills, where subterranean water occurs, vegetation is more abundant, and there flourishes the melkbosch, a sappy euphorbia-like plant, always accompanied by a stately parasite; its dark grey bushes, 5 to 8 feet in height, being dotted over the sandy plain like hay-cocks in a meadow. Farther east appear thorny shrubs, which gradually become more numerous, and are eventually accompanied by an aloe (*Aloë dichotoma*); and beyond this again, the country slowly loses its desert-like character, and the acacia-woods and barren aristida-plains of the Kalahari commence.

On the open stretches of the karu deserts, or semi-deserts, of South Africa, which attain a height of from 5000 to 6000 feet above sea-level, the vegetation is of a richer and more varied type. The banks of the mostly dry river-beds are covered, for instance, with dwarf acacias, and other kinds of bushes and shrubs; and, although mostly bare during the dry season, become green with bulbous plants when fertilised by the warm spring rains; the other vegetation consisting of succulent plants and various ferns of a heather-like appearance.

The most remarkable plant of this tract is undoubtedly *Welwitschia mirabilis,* a plant discovered near Mossamedes by the traveller, Welwitsch, in 1860, but which also grows abundantly around Walfisch Bay, as well as on the stony plains of the coast. Its short, almost bulbous stem, devoid of branches, and clothed with a reddish bark, rises only about 4 inches above the ground, but sends down a long tap-root. The summit, divided into two lobes and measuring as much as 13 feet in circumference, is hollowed out like a dish, and bears on its edge a pair of long, band-shaped leaves, standing opposite each other, these being the only leaves developed, with the exception of the two seed-leaves, or cotyledons. During the life of this strange plant, which seems to live for at least a century, the single pair of leaves gradually wither and die towards the tips, but grow continuously from the base. In young plants their edges are entire, but with increasing age they become split up into crooked strips, lying irregularly on the ground. On the edges of the discs are developed cones, the welwitschia being a relative of the conifers.

While the welwitschia is restricted to the stony ground among the sand-dunes, another remarkable desert-plant clothes their summits and slopes, namely, the naras (*Acanthosycios horrida*), which attains a height of about 5 feet and belongs to the same group as cucumbers and gourds. Its widely branched, green, solid stems, are about an inch in thickness, and in the apex of the withered leaves grow series of stout thorns arranged opposite each other. When its roots, which are 4 inches in thickness and no less than some 50 feet in length, tap the subterranean water of the desert, the plant soon rises above the loose sand by which it is often buried, and so gradually becomes the centre of a hillock, the summit of which becomes crowned with the bush. When there is sufficient moisture below, this develops a number of juicy fruits resembling large oranges in size and shape. While the other parts of the naras bush are avoided on account of their exceedingly bitter taste, the fruit, when fully ripe, loses this bitterness, and its aromatic pulp is then largely consumed by jackals which act as distributers of its seeds.

Of the higher mountains of Ethiopian Africa, one of the best known is Kilimanjaro, whose snow-clad summit towers to an elevation of 20,000 feet. At its base this mountain is clothed with low forests growing on dry soil; but at a height of 5000 feet these are succeeded by a luxuriant, damp forest extending as high as 9000 feet or more. This soon ceases to be a true tropical forest, being almost devoid of palms and creepers, although one clematis ascends to the tree-tops, whence it sends down stems as thick as ropes. The other creepers are mainly herbaceous, and wholly confined to the brush-wood; the tallest of them being Meyer's begonia, the most magnificent ornamental plant of the forest, which in flowering time adorns the otherwise monotonous green with millions of yellow-centred white spots, sometimes packed so close together as to form a veritable sheet of snowy blossom. Slender trees with tall smooth trunks of more than 60 feet in height are seldom seen, at least on the southern slope of the mountain, while on the northern aspect they are represented by a single species of juniper. Some isolated trees have trunks as thick as an oak, but at a man's height from the ground they begin to branch, and soon become thick masses of foliage. Between these rise more slender trunks, which struggle a little higher towards the light, but likewise form branches low down and bend upwards to bear foliage only at the top. Between these trees, which have only medium-sized leaves, grows other vegetation, consisting partly of saplings of tall species, and partly of other plants, from 15 to 30 feet high, which thrive in shade, and branch from the base, or after the development of a stem as tall as a man and as thick as his arm.

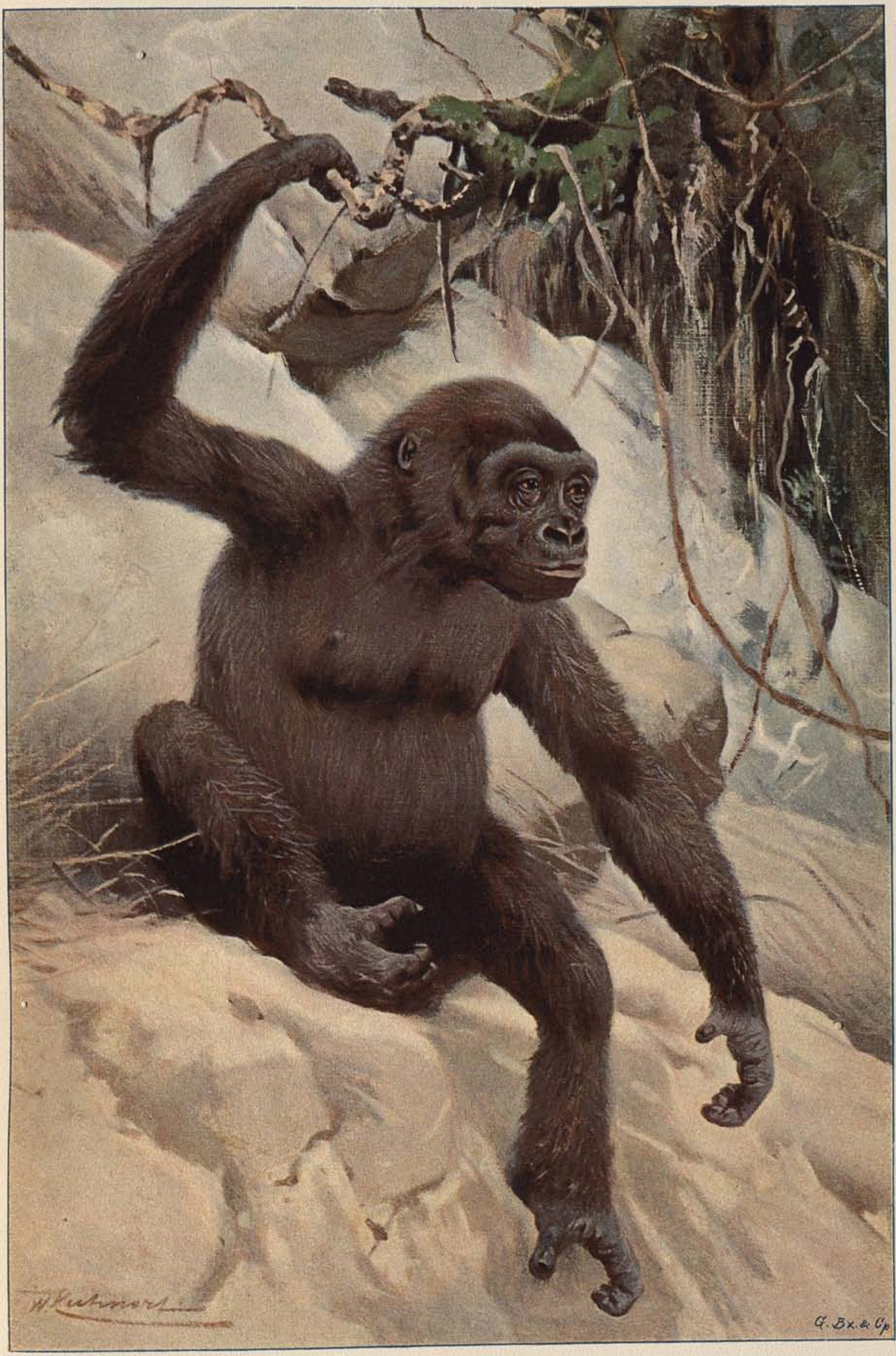
Lower still grows a zone of dracænas, and two kinds of tree-fern peculiar to the western slope of the mountain. A third zone, from 3 to 10 feet in height, is formed by herbaceous plants, of which *Lobelia volkensi* is the stateliest, although by no means the commonest. In appearance this lobelia resembles a small palm, and from its crown, formed by long drooping leaves, rises an erect inflorescence, like a gigantic ear of corn 6 feet in height. The ground is covered by a close carpet of herbaceous plants, coarse grasses, ferns, and selaginellas, on which are dotted numbers of the most varied flowers. The luxuriant forest, from the ground to the tree-tops, is a dense mass of foliage, almost hiding the boughs and trunks. Below, above, and around, nothing can, in fact, be seen but the green of the leaves; and most of the trees themselves are covered with flowerless parasitic plants, some of which hang down in veils a yard or more in length, while others resemble gigantic birds' nests or bolsters. Very conspicuous is a pale grey bearded-lichen (*Usnea barbata*), which grows everywhere; while the mosses graduate through every shade from the darkest to the brightest green. Round the lower part of the trunks, especially those of the thicker trees, the parasitic plants extend to meet those drooping from above; ferns, lycopodiums, and orchids growing in such profusion as completely to hide the bark of the tree.

From 8000 to 10,000 feet upwards the flanks of Kilimanjaro form a mountain meadow, on which the clumps of grass, although growing near together, are wide enough apart to render walking difficult. During the dry season the floor of this network is bare, or covered merely with mosses and lichens, but during and shortly after the rainy period, millions of flowers spring up, transforming the tract into a gorgeous Alpine meadow. The few isolated trees, of which there are not many kinds, range in height from 15 to 25 feet, and, in consequence of the north-easterly winds of autumn, are mostly bent towards the south-west. Many are dead, and numerous lichens, especially the grey streamers of the bearded species, thickly drape their branches.

Still higher up the mountain the grass grows more sparingly and the lava-slopes, strewn with large boulders, produce only stunted bushes, which gradually lead up to a desert-tract. Above 14,000 feet the grass grows no higher than the hand, its tussocks being scattered like dots over the stony soil. In another thousand feet are reached the last sentinels of vegetation, forming small isolated groups sheltered among the stones. Higher still comes the realm of mosses and lichens, at least where the soil is dry, although in spots where rain, or snow, collects there are usually small patches of vegetation.

In south-east Africa the country rises from the sea in a series of treeless table-lands, the forest being restricted to the streams in the sheltered valleys, while the flanks of the mountains bear little but grass. The climate of the Drakensberg range is stormy and inclement, the mean annual temperature being only from 43° to 50° F., while the severe night-frosts which prevail in winter do not permit the growth of bushes, except in sheltered ravines.

Gorilla. Among the fauna of the forest-zone, the first place is claimed by the great greyish black man-like ape commonly known as the gorilla (*Anthropopithecus gorilla*), although its proper native name would appear to be pongo. To describe this monstrous ape, whose main habitat is formed by the teeming tropical forests of the west coast, in detail on the present occasion is quite unnecessary. As regards bodily size, it is generally stated in text-books that the typical gorilla of the Gabun and adjacent districts does not exceed 5½ feet in height, this estimate being deduced from the stuffed specimens brought by du Chaillu, and skeletons in the British Museum and elsewhere. In proportion to the bulk of the animal, this height is relatively small, and is due to the shortness of the hind-legs. This height is, however, considerably exceeded by a gorilla in the museum at Tring, shot some years ago in the hinterland of the Cameruns. On the other hand, the type specimen of *A. g. beringeri*, from German East Africa, is stated to stand only about 4 feet 11¼ inches, and to have weighed only 100 kilogrammes. In contrast to this is an enormous gorilla killed near Wessu, on the Sangha River, in Congo territory. This animal, a male, was one of a party of three, and photographs in a sitting posture were taken in the flesh on its arrival at Wessu, alongside two natives, of whom one is standing. The height of the standing native is not given, but, as shown in the photographs, the head of the gorilla in the sitting posture reaches well up to his waist. The entire animal is stated to have measured not less than 7 feet 6¾ inches, and to have weighed 350 kilogrammes. Seeing that the length-measurement exceeds that of the



GORILLA.

British Museum gorillas by 2 feet, one hardly dares to believe that it indicates the height from heel to crown, and that it does not include the length of the foot, and further information is required with regard to this point. Even, however, if the measurement is from the crown of the head to the toes, it indicates a monster far exceeding the British Museum examples in size, and thus one of the biggest examples of its kind hitherto recorded.

Although there is only a single species of gorilla, yet this is divisible into a number of geographical races, owing to the fact that their habitats are circumscribed, and that there is no evidence that these animals can swim. Of the typical Gabun gorilla there is a red-headed and a dark-headed variety, as there also is of the race from the south Cameruns (*A. g. matschiei*); in the typical form the red-headed individuals (the so-called *A. castaneiceps*) outnumber the dark-headed ones by four to one. Of the south Cameruns race the skins are too few to enable the proportion to be estimated. The race from the north Cameruns (*A. g. diehli*) is distinct, and as it possesses a beard, it appears to be identical with *A. g. beringeri*, from Kirunga, in German East Africa. Of another race (*A. g. jacobi*) the type was obtained in the west central Cameruns, and is distinguished by the immensely broad bones of the skull, compressed face, and large size. A dark-headed male from the same region is one of the largest brought to Europe, exceeding the height-measurement of the type of the south Cameruns gorilla by 4 inches, which makes it 5 feet 10 inches high. The north Cameruns gorilla, which is of smaller size than the rest, has a long black beard, and the whiskers, which in the other races are ashy grey, are also black.

It may be added that in the typical Gabun race the ground-colour is blackish grey; many specimens showing on the crown a mixture of reddish brown hair. As they get old the males take on a whitish grey tinge on the upper part of the thigh and the lower part of the back. These animals go in small troops, the young males leading the way, the females following, and an old male, the lord of the troop, bringing up the rear. When he has selected a resting-place he is fed by the females. At night these and the young males sleep among the branches of trees, forming a kind of seat of twigs, as chimpanzis also do. The old male takes up his position at the foot of the tree, leaning against the stem.

It is not always easy to distinguish between some of the larger races of the chimpanzi and small gorillas; but the following points have been recently stated by an eminent anatomist to be distinctive of the heads of the two species:—

"In the head of the gorilla the chief points of interest to be noted are the prominent brow-ridges, the flatness of the nose, the remarkable elevations on each side of the nasal aperture, the short but prominent upper lip, and the small ears with inconspicuous lobules. The nuchal region is not depressed as in man, for in the gorilla the great development of the muscles of the back of the head fills up the space between the head and the shoulders. . . . The head of the chimpanzi is smaller and rounder, and though the brow-ridges are very prominent and the upper part of the nose is depressed, yet the physiognomy is very different, owing mainly to the smaller size of the nasal alæ and the long protruding upper lip. The ears, too, are different, being very large. There is also a slight but distinct nuchal depression."

Female gorillas are considerably smaller than males, and slighter in build. Their canine teeth project but little, the head is proportionately smaller, the nose shorter, the cheeks wider, and the upper lip longer, so that the female is not quite so hideous as the male. This difference in the size of the sexes is another distinction between the gorilla and the chimpanzi. Other distinctive features of the gorilla as compared with the chimpanzi are the greater length of its arms, which reach below its knees when in an upright position, but never so far as beyond the middle of the lower portion of the leg, a feature by which the gorilla is also distinguished from man. Besides this, the last upper molar tooth of the gorilla, corresponding to the upper wisdom-tooth of man, is larger than the two preceding ones, a peculiarity in which the gorilla is distinguished from both man and the chimpanzi. Yet the gorilla has, unlike the Malay orang-utan and gibbons, various points in common with the chimpanzi and man. Among these are the presence of seventeen vertebræ between the last neck-vertebra and the terminal joint of the spine. The gorilla, in common with the chimpanzi, differs from man by having thirteen pairs of ribs; but all three resemble one another in having eight bones in the wrist, instead of the nine found in other apes and monkeys.

One of the favourite haunts of the gorilla is the Sierra do Cristol, which forms a chain of mountains whose upper slopes carry a forest of lofty trees, while their valleys are carpeted with coarse grass and clothed with bushes. Fruit-trees of various descriptions grow in rich abundance in the high forest, as well as in the valleys; and these supply the great apes with suitable food throughout the year. The "cabbage" of the oil-palm, and the so-called grey plum (*Parinarium excelsum*), a somewhat insipid fruit of the size of a large plum, the fruit of the papaw-tree (*Lorica*), and wild bananas are reported to be special favourites of the gorilla.

According to the reports of modern travellers and natives, gorillas live in small families, consisting of the two parents accompanied by several young of various ages, which abide in the darkest depths of the primeval forest, lit up only by a dim light on sunny days, but reminding one of an eclipse of the sun in cloudy weather. In districts where the gorilla lives there prevails a hot damp temperature, like that of a Turkish bath or a strongly heated hothouse, the silence of the primeval forest scarcely ever betraying a sign of animal life and being only now and then broken by the note of some bird. In such situations the gorilla makes a sleeping-place of branches, which are covered with twigs and moss. In this nest, placed several yards above the ground, the females and young are reported to sleep, while, as already mentioned, the old male spends the night sitting erect close by, ready to defend his family against the attacks of roving leopards. Gorillas do not apparently use the same platform more than three or four nights in succession; this being rendered probable by the fact that they have to change their abode frequently for the sake of food. Gorillas apparently seek their food only during the day, and rest during the night. They generally walk upon all fours, with the fingers doubled up towards the inner side. Despite the clumsy appearance of the male, gorillas are agile and indefatigable climbers, and are supposed to ascend to the tops of the highest trees in the forest, and move from tree to tree with as much agility as the light and slender spider-monkeys of Brazil. Apparently they are also able to jump to the ground from considerable heights without harm; an adult having once been seen to leap from a height of 10 or 12 yards before disappearing in the bushes. When driven to bay, the gorilla is no doubt a most formidable adversary, but many stories in regard to its ferocity are certainly exaggerated. According to recent reports, gorillas never attack human beings unprovoked; on the contrary, they avoid meeting them, and as a rule hasten away as soon as they become aware of man's approach, uttering peculiar guttural sounds, which probably denote fear.

The German explorer Koppenfelt was probably the first European to kill gorillas, of which he shot four in 1874. Before that date gorillas had been shot by negroes, but in most cases, at all events, only on accidental occasions, and not as the result of regular hunting for the animal. Many gorillas are probably killed by spears suspended in paths frequented by these animals, so as to pierce the back; and the gorillas of which the skins were received at the British Museum from du Chaillu had been killed in this manner.

The following notes were written by a gentleman who resided for some time in the Cameruns:—

"One evening in May 1887 a young gorilla was brought to me at Mambé for sale, and I bought it for a few shillings in goods. Well do I remember its bullet-shaped head, black face, great hairy chest, and its grip like iron when I shook hands with it. It was only a baby gorilla, about 3 feet 6 inches high, and lived about two months, when it succumbed to an attack of diarrhœa. We fed it for some time on a small red nut which is found in the bush, and of which it eats only the kernel (its natural food I believe), and then tried to accustom it to other food such as tinned milk, bananas, etc. Near where I lived at this time, and right in the gorilla-country, were two white traders who devoted a good deal of time to hunting various animals, and, among others, the gorilla. I was told that the following was one of the means adopted to catch one alive. On discovering the track of a gorilla with a lot of mongrel dogs, of which there are plenty on the west coast, they would surround the gorilla, when the curs would yelp and bark at its heels; then a number of natives would move in a circle with a long rope, gradually coming closer and closer until the gorilla was suddenly made fast and thrown helpless to the ground. It is not owing to the scarcity of gorillas that we do not see them oftener in Europe. The difficulty is to find a proper substitute for their natural food; another drawback being that, so far as my experience goes, they become very sulky in captivity. The usual plan adopted when sending one over to Europe is to put a chimpanzi in the cage for company."

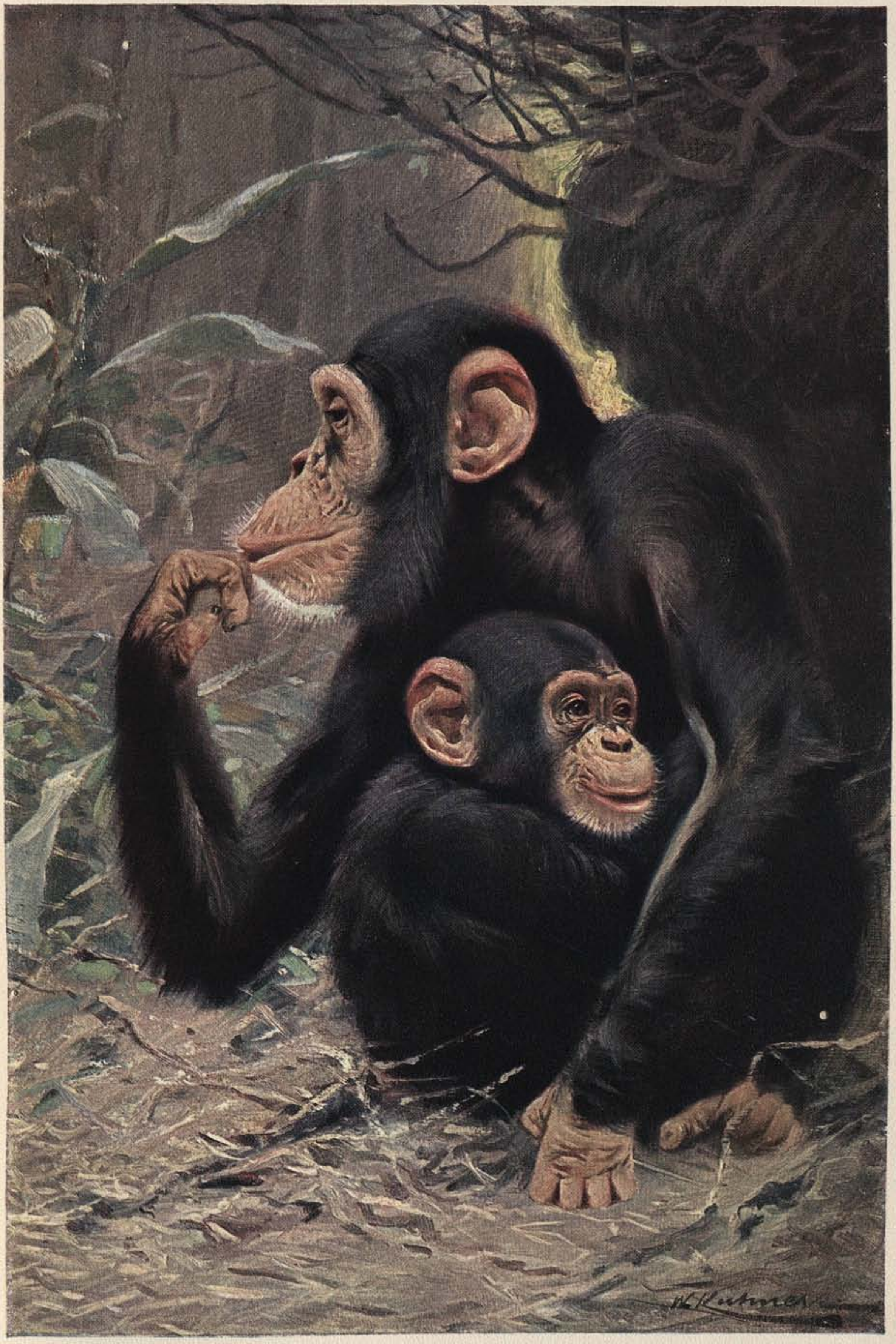
A captive gorilla brought some years ago to the station of Chinseoseo in Loango arrived in a deplorable state; but by means of the milk of a goat, and plenty of wild and other fruit, its owners succeeded in restoring its health. This animal was allowed to run about unchained, and under little supervision, on the ship which took it to Europe. It was apparently very gentle, and although independent, never savage. At meals it behaved very decently: it helped itself from a plate, clutching the food with its thumb and two fingers, and drank from a small basin which it raised to its mouth and put back in its place unbroken. From very small dishes, however, it used to suck the water by bending its mouth down to them. It had a great love for cleanliness; if anything was sticking to its hair, it either tried to wipe it off, or asked the sailors by an unmistakable gesture of extending its arms to take it off. If unable to get any object it wanted, it knew how to arrive at its purpose by other means. If it wanted sugar or fruit from the cupboard in the dining-room it suddenly interrupted its play, but instead of going directly into the room, as soon as it knew itself to be free from observation it turned in that direction, and then went straight down into the room, opened the cupboard, and clutched the sugar-basin or fruit-dish.

Chimpanzi.

The second African man-like ape is the chimpanzi (*Anthropopithecus troglodytes*), which is likewise an inhabitant of the equatorial forest-zone, where, however, it has a wider range than the gorilla. Some of the features distinguishing the chimpanzi from the gorilla are noticed under the heading of the latter, and it is unnecessary to say more, except to add that in the skull the nasal bones of the gorilla descend much lower than do those of its relative. The typical West African chimpanzi is a considerably smaller animal than the gorilla, but there are certain local races of the former which approximate much closer in stature, as well as in the form of the head, to the latter. The well-known ape named "Mafuka," which lived for some time in captivity in Dresden, was one of these gorilla-like chimpanzis, as was also "Johanna," a female which was exhibited alive some years ago in England. Another large local race is represented by du Chaillu's kulu-kamba (*A. troglodytes kulu-kamba*); while a fourth race is the so-called bald chimpanzi (*A. t. calvus*).

The distributional area of the chimpanzi includes a considerable tract in west and central equatorial Africa; the limits of its range being formed approximately by the twelfth degree of latitude on each side of the equator, while in the opposite direction the range extends from the west coast to the great lakes in the heart of the continent. Like all man-like apes, the chimpanzi is a native of the forests, and subsists on fruits of various kinds. In many districts it is a more exclusively arboreal animal than the gorilla, but in the south-western portion of its range it spends much of its time on the ground. This is notably the case in the Niam-Niam forests, where the trees form almost impenetrable thickets, their stout trunks being generally thickly overgrown with wild pepper, while the branches are clothed with large hanging beard-like lichens and peculiar ferns commonly known as elephants' ears. Many of the decaying trunks support a climbing leguminous plant with yellow or white flowers and long leathery pods, whose hanging garlands form bowers enveloped in perpetual gloom. In the higher branches of the trees are generally to be found nests of forest-ants. When in a home of this nature, chimpanzis seem to be constantly shifting their abode, in order to find fresh and sufficient supplies of fruit.

In the wild state chimpanzis are reported to flee, in most instances, at the sight of man, although if brought to bay they fight savagely and fiercely. They are said to seize leopards by their paws and to bite them severely, sometimes to such an extent as to cause death. If they are wounded in such contests, they retire as soon as possible to retreats among the trees, where they loudly bewail their ill-fortune. Lions, although they will not eat them, are stated to attack chimpanzis and tear off their limbs.



CHIMPANZEE.

So much has been written with regard to the behaviour of chimpanzis in captivity that it will suffice to refer to but one account. This relates to an individual known as Consul II., which was exhibited in Berlin at a meeting of the German Psychological Society, where it formed the subject of a lecture by an eminent psychologist.

The ape stood on the platform beside the lecturer in a smoking jacket, top-hat, black trousers, boots, and shirt. The professor gave Consul an excellent character. He had good manners, was of a friendly disposition, and manifested symptoms of what would be called in human beings a loving nature. He had no objection to the vicinity of dogs, cats, or snakes, but was afraid of horses. No traces were seen in Consul of any special liking for women or soldiers. Like most apes, he delighted in children, but evinced an abhorrence of dolls, of which he could make nothing, and retired vanquished from their presence. If Consul was tickled he sometimes shrieked with laughter. When punished he acted like a child, holding his hands before his face. If discovered doing anything forbidden, he assumed hypocritically an innocent demeanour which was distinctly human. In disposition he was restless, and could not sit long in one position. With an excellent memory, he was yet incapable of expressing his wants either by gesture or sound. He could not be taught to whistle, nor did he understand human speech; all he could comprehend being the tone of a voice or the rhythm of words. Neither could he be taught to reckon. Although the psychological abilities of Consul were separated from those of human beings by a wide gulf, it is interesting to note how many complicated actions he could comprehend with the limited intellectual powers of which he was possessed.

Guereza Monkeys.

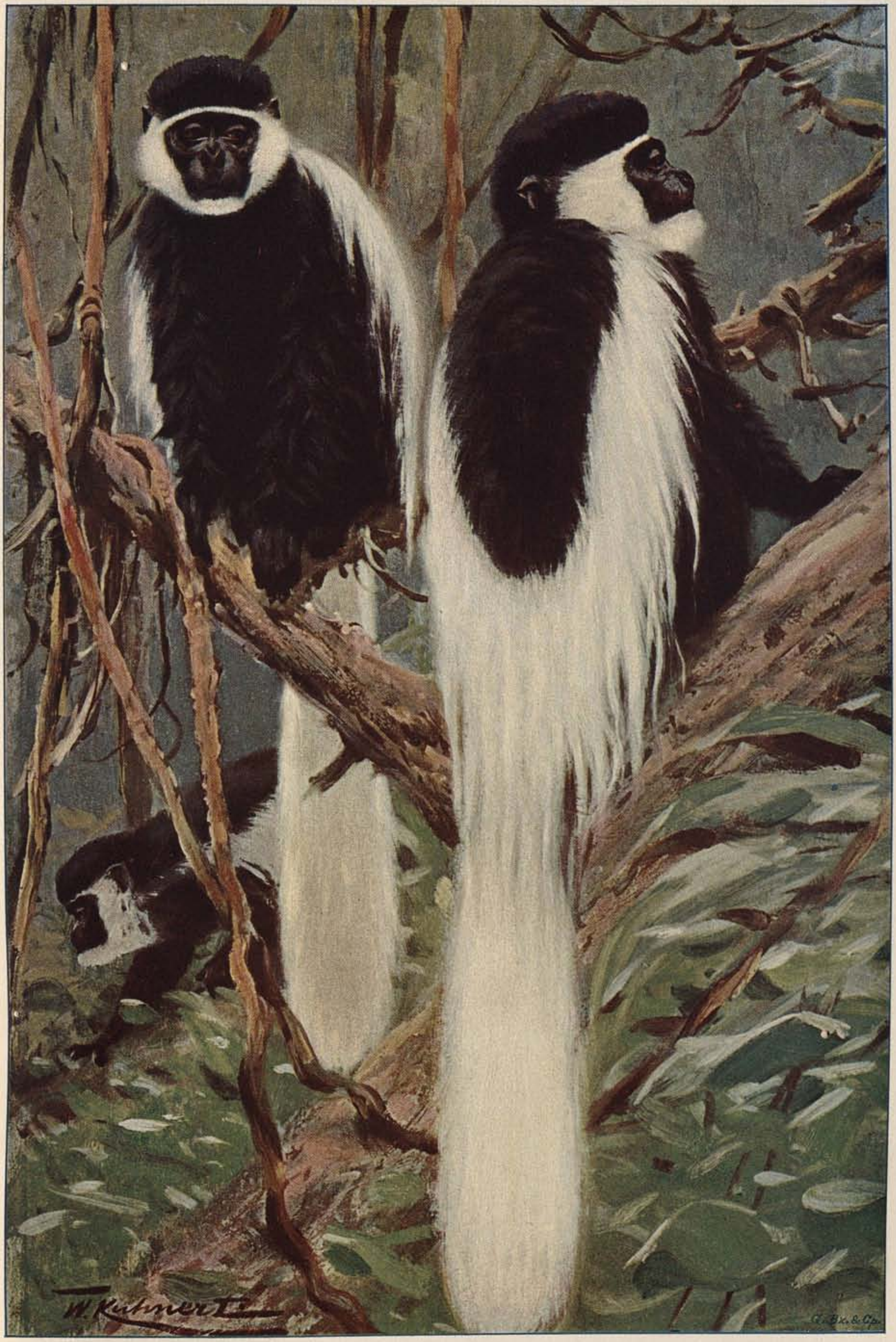
Leaving the man-like apes, attention may be directed to the guerezas, a group of strikingly coloured monkeys characterised by the rudimentary condition or total absence of the thumb. They belong to a genus unknown in any other part of the world; agreeing in this respect with all the other monkeys of Ethiopian Africa except the dog-faced baboons, which range into Arabia. Most guerezas are distinguished by the length and beauty of their soft silky hair. The group is most numerously represented on the west coast; but the true or typical guereza (*Colobus guereza*), so called by the natives, inhabits central and southern Abyssinia. Nearly allied species range to the south and south-west through Gallaland and Somaliland to Kilimanjaro. The coat of the members of this typical group is very long, and in colour a mixture of glossy black and creamy white; the latter usually forming a mantle on the back and occupying the whole of the fringe-like tail. These monkeys dwell amid the branches of trees clothed with the above-mentioned bearded grey lichen, and harmonise so closely with these surroundings that it is said to be often impossible to detect them, even at comparatively close quarters.

The black guereza (*C. satanas*) of West Africa differs from the preceding species by its uniformly black coat, as well as by the presence of a kind of crest on the head and the absence of a long fringe of hair on the tail. Another West African species, the king guereza (*C. polycomus*), has long hair on the sides of the hind-quarters, and is glossy black with a white mane, forehead, cheeks, and tail, the latter terminating in a tassel. The bear-like guereza (*C. ursinus*), from the same district, is similar in colouring but with a greyish mane. From the king guereza, *C. angolensis* of Angola differs in having the chest and at least the terminal two-thirds of the tail white. The white-thighed guereza (*C. vellerosus*), on the other hand, is black with a white chin, tail, and thighs; while the bay guereza (*C. ferrugineus*), of Gambia and the Gold Coast, is greyish on the crown and upper-parts, and bright reddish brown on the cheeks, throat, under-parts, and limbs. Finally, the light brown crested guereza (*C. cristatus*) has the white hair of the head long enough to be parted down the middle, that of the forehead radiating from two whorls on the temples.

The black and the black-and-white guerezas form an interesting instance of the evolution and gradation of colouring. Starting with a wholly black monkey, like the West African *C. satanas*, in which, although there is a fringe of long hair round the face, the body is comparatively short-haired and the tail not tufted, a gradation can be traced through species like *C. palliatus* and *C. sharpei* of east central Africa, in which tufts of long white hair (larger in the second than in the first of the two species named) make their appearance on the sides of the face and shoulders, as well as on the terminal third of the tail, to the Abyssinian *C. guereza*, in which the white shoulder-tufts extend backwards to form a mantle on each side of the body, and uniting on the lower part of the back. The culmination of this type is formed by the white-tailed guereza (*C. caudatus*) of the Kilimanjaro district, in which the pendent white mantle is still longer, and the tail, which is wholly white except for a small length at the root, is clothed with long drooping hair; the cheek and throat tufts, however, have been lost, so that the head is short-haired, with the face and throat white.

The West African white-thighed guereza (*C. vellerosus*) appears to exhibit a kind of retrograde development in these respects, the body having lost the mantle of long white hair and the tail its white "flag," while the white of the perineal patch has spread on to the hinder and outer sides of the thighs. In this case we find practical reversion to the type of the black guereza, with the exception that the band on the forehead, the sides of the face and throat, the thighs, and almost the whole tail have become white, while the long hair has disappeared from the face. Probably the colouring and special development of the long hair in the white-tailed guereza form a protective modification, but the purport of the colouring of the intermediate forms between this and the black guereza has not been determined.

Guenon Monkeys. The so-called guenons form another exclusively African genus of monkeys, with a distribution extending from Gambia and Abyssinia to the northern districts of Cape Colony. These guenons, forming the large genus *Cercopithecus*, are divisible into a number of groups characterised by certain peculiarities of colouring. The first of these is the spot-nosed group, distinguished by a heart-shaped white spot on the nose, accompanied by a white or greyish white under surface to the body; the inner sides of the limbs, the lower side of the tail, at least at the base, being also white. Of the various species, the lesser white-nosed guenon (*C. petaurista*), from the Gold Coast, is very common in captivity, Büttikofer's guenon (*C. p. buettikoferi*), from Liberia, being a local race lacking the black line which in the first-named species crosses the forehead and



GUEREZA.

encircles the crown behind. The Congo guenon (*C. ascanias*), with a local race in the form *C. a. schmidti*, on the western shores of Tanganyika and Uganda, is an allied species in which the large white cheek-tufts are very noticeable. Typically there is a black brow-band extending as far back as the ear, and another black stripe below the tuft in front of the ear. Another group is typified by the moustache-monkey (*C. cephus*), from the Gabun and the Congo, recognisable by the blue nose-spots and the yellow cheek-tufts. When a heart-shaped spot is present in this group, it is not accompanied by white on the belly, the inner surface of the limbs, or the under side of the tail. In the green-backed group the western green monkey (*C. sabœus*), ranging from Senegambia to Liberia, and the vervet (*C. pygerythus*), from South Africa, are common menagerie species, and have bred in the London monkey-house, the former in 1890 and the latter in 1893. In *C. sabœus* there is no distinct white brow-band, which is, however, present in the black-faced *C. æthiops* of Abyssinia, distinguished by its large white whiskers, and the presence of silky white hairs on the lips and chin. These chin-hairs are wanting in the vervet and in *C. tantalus* of Nigeria, which are likewise black-faced and white-browed monkeys.

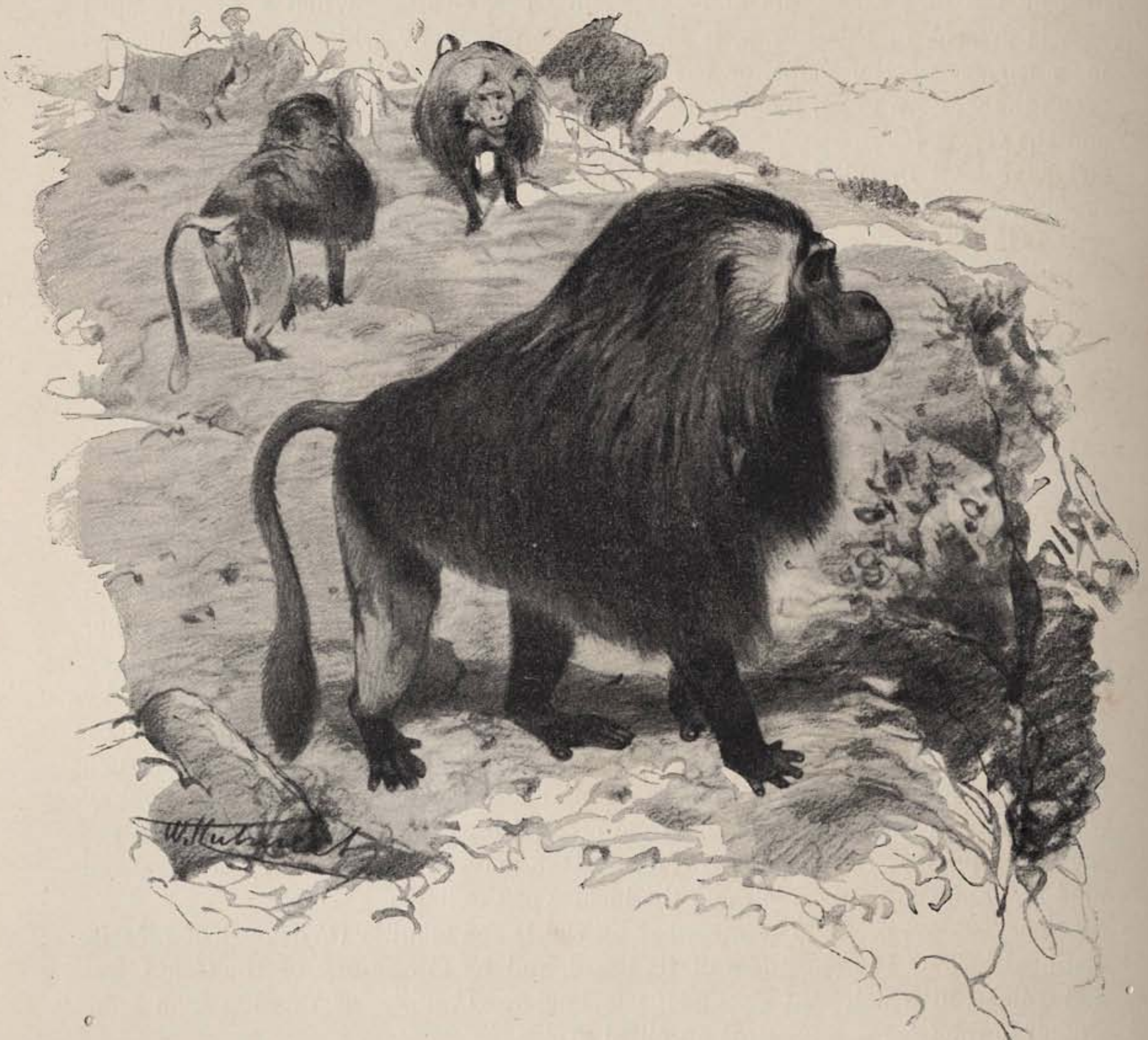
The red-backed group is represented by the large red patas monkey (*C. patas*), from West Africa, and the rarer nisnas (*C. pyrrhonotus*), from Kordofan, Darfur, and Somaliland; but both of these may perhaps be regarded as races of a variable species.

To another group, characterised by the prevalence of black or dark grey, belongs the diadem-monkey (*C. leucampyx*), from West Africa, distinguished by the white ear-patches, greyish back, and pale colour of the under-parts, and represented by local races, such as the East African *C. l. stuhlmanni*, in other parts of the continent. The mona (*C. mona*) and the rarer Campbell's monkey (*C. campbelli*), both from West Africa, represent another group characterised by the contrast between the pink of the lips and the grey of the sides of the face. In the same group are included certain species, distinguished by large ear-tufts, such as Gray's monkey (*C. grayi*), from the Congo and the Gabun, and Wolf's monkey (*C. wolfi*), from the Congo. The Gabun race (*C. grayi nigripes*) of the former has the lower part of the back black; the latter may be recognised by the rust-red hind-legs and the light patches on the insides of the limbs.

The bearded group is represented by the Diana monkey (*C. diana*), of Liberia, distinguished by the shortness of its beard, and by *C. roloway*, of the Gold Coast and Guinea, in which that appendage is longer. *C. neglectus*, ranging from Lake Rudolf to the Congo, represents an allied group.

Mangabeys. The mangabey monkeys, which are chiefly West African, are typically characterised by their flesh-coloured upper eyelids and ringed hair, a well-known species being the collared *Cercocebus collaris*. In the male of the orange-chested *C. chrysogaster* of the Congo, as well as in both sexes of *C. hagenbecki*, the upper eyelids are, however, dark-coloured. Allied to the true mangabeys is the white-cheeked *C. albigena*, a black and crested monkey with dark eyelids, of which there are several local races, one of these, *C. a. johnstoni*, inhabiting the neighbourhood of Lake Tanganyika.

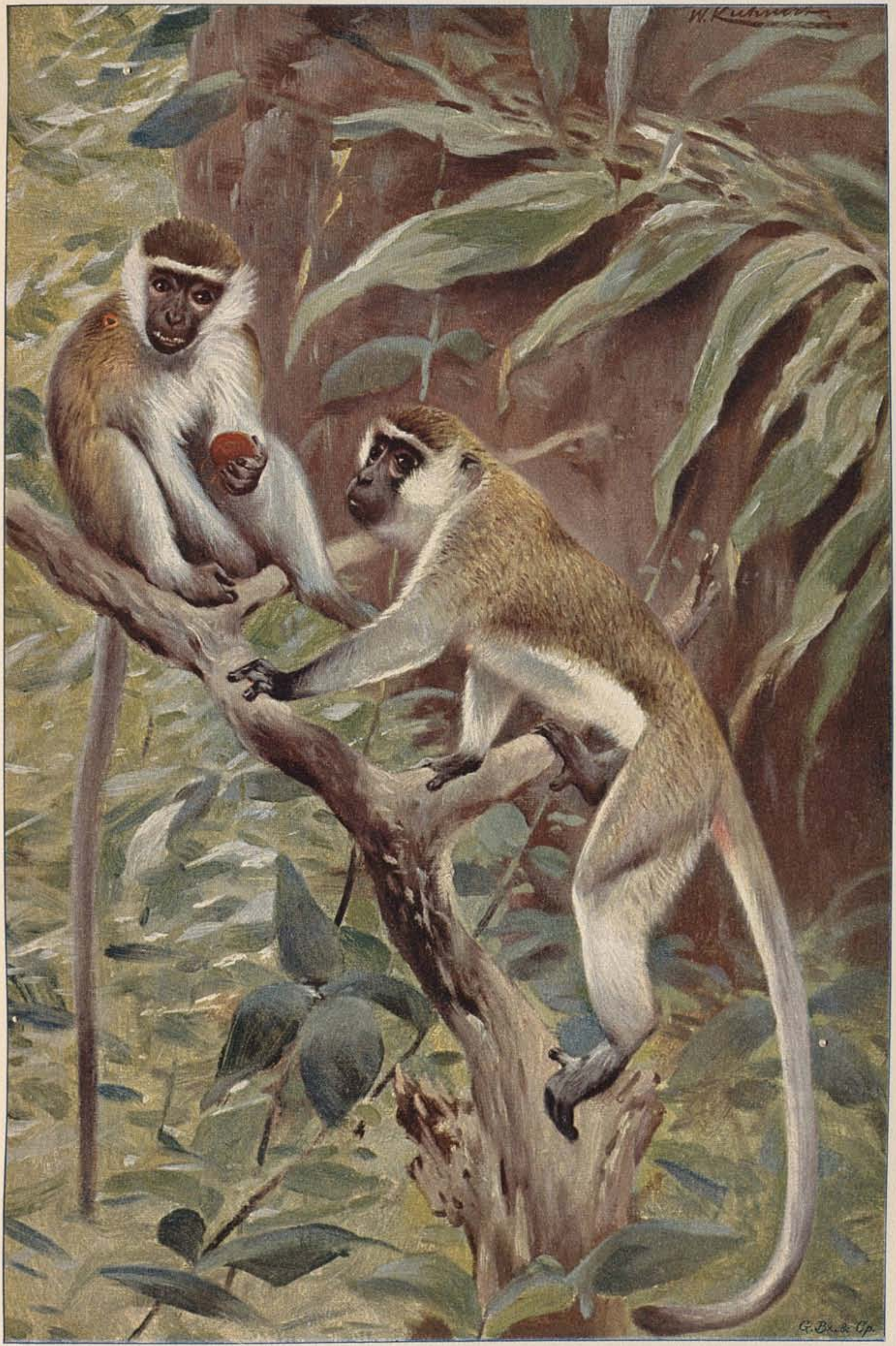
Gelada Baboon. The southern districts of Abyssinia form the home of the gelada baboon (*Theropithecus gelada*), a rather large species distinguished from the true dog-faced baboons by the presence of an enormous mantle of long hair on the fore-quarters, which, however, leaves the chest bare, and the tufted tail. From these peculiarities, it is frequently called the lion monkey. It is dark-coloured, with the bare parts crimson.



GELADA BABOONS.

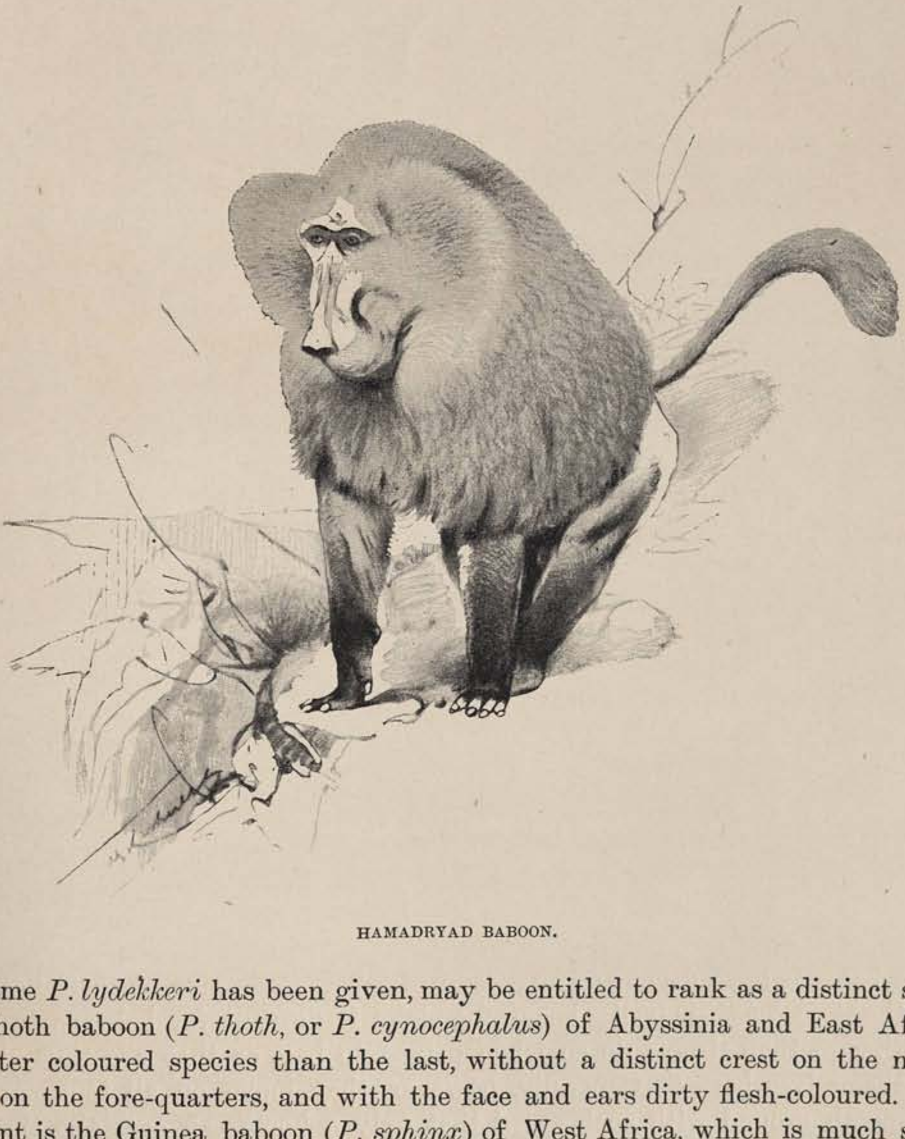
Dog-Faced Baboons. The more typical representatives of the dog-faced baboons of the genus *Papio* (or *Cynocephalus*) are connected with the gelada by means of the hamadryad or maned baboon (*P. hamadryas*). which is a native of Abyssinia, with an outlying local race (*P. h. arabicus*) in Arabia. This baboon has a profuse mane but not the bare chest-patch and the tail-tuft of the gelada. Young males and females of all ages are dark olive-brown, but in old males the mane and cheek-tufts become pale ashy.

Of the more typical members of the group the anubis baboon (*P. anubis*),



GREEN MONKEY.

whose range extends right across the continent from the west to the east coast, is a large species with a crest of long hair on the back of the neck and an incipient mane on the fore-quarters. The general tone of colour is dark yellowish olive speckled with black, the individual hairs being ringed with different colours. The face and ears are dusky. One of the eastern races of this species is *P. a. neumanni*, characterised by certain peculiarities in the skull; and *P. a. doguera*, of which the geographical range extends from Abyssinia to the Congo, represents a second local form. On the other hand, a baboon from eastern Africa, to which the name *P. lydekkeri* has been given, may be entitled to rank as a distinct species. The thoth baboon (*P. thoth*, or *P. cynocephalus*) of Abyssinia and East Africa is a lighter coloured species than the last, without a distinct crest on the neck or mane on the fore-quarters, and with the face and ears dirty flesh-coloured. Very different is the Guinea baboon (*P. sphinx*) of West Africa, which is much smaller and redder, with a slaty face and large ear-tufts. In South Africa the group is represented by the chacma (*P. porcarius*), a very large dark-coloured species, with the cheek-tufts, nape, and some other parts of the body almost black, and the hairs uniformly coloured throughout their length; it is represented by a local race in the Transvaal.



HAMADRYAD BABOON.

Dog-faced baboons generally inhabit rocky districts bordering on plains or cultivated ground; their short legs rendering them better fitted for a life on the ground than for climbing. In all cases they associate in large troops, and as they are both fierce and strong, they are exceedingly dangerous animals to encounter. They themselves are much exposed to the attacks of leopards and other Carnivora, which may be the reason for their associating in large troops. The males, which much exceed the females in size, are armed with powerful canine teeth, not greatly inferior in penetrating power to those of the leopards, and more than once several old male baboons have driven away a leopard. The large size of their heads, as well as the shape of their bodies generally, make it difficult for baboons to stand erect, although they always do so when driven to bay, as they are thus able to defend themselves better. Generally, however, they move on all fours, and on fairly smooth ground with such speed that only a horse can overtake them.

THOTH BABOON.

Although the chief part of their food consists of seeds, fruits, roots, and the gum secreted by the stems of many African acacias, baboons also eat insects, lizards, and birds' eggs. When they visit the plantations of the natives, which suffer much from such nocturnal raids, they are reported to post sentinels to give notice of approaching danger.

The hamadryad, which may have been indigenous to the delta of the Nile in early times, or may have been imported from Abyssinia, was held sacred by the ancient Egyptians, and consecrated to the god Thoth. The stone effigies of these apes in all cases represent old males, sitting with their hands on their laps, and the body enveloped in the mane, which forms a large mantle. In spite of the city of Hermopolis—the town of Thoth—being devoted to its cult, and a special tomb at Thebes assigned to its mummies, the ancient Egyptians apparently employed the hamadryad for useful services. This is shown in the sculptures, one of which represents a sycomore-fig loaded with fruit, in the branches of which sit three apes, easily recognisable as hamadryads, which hand the fruit down to two slaves standing beneath the tree, and holding baskets filled with the figs. It thus appears that the ancient Egyptians had succeeded in taming and training these apes in the same way as the Malays in Sumatra are reported to have done in the case of one of the long-tailed langurs, which they employ in gathering cocoa-nuts.

Mandrill and Drill.

Although often included in the genus *Papio* with the ordinary dog-faced baboons, the two hideous, short-tailed West African baboons known as the mandrill and the drill are regarded by many naturalists of the present day as entitled to form a genus by themselves under the respective designations of *Mormon maimon* and *M. leucophæus*. Justification for this separation is afforded by certain differences they present from the more typical dog-faced baboons. These include the short or rudimentary tail, the presence of curious fluted swellings on the sides of the nose, the peculiarly shortened form of the body, and the great length of the front as compared with the hind limbs. All these peculiarities are most developed in the adult males of the mandrill, which have the swellings on the sides of the nose bright blue, and the other bare portion of the face, inclusive of the nose, brilliant scarlet; the latter colour also appearing on the naked callosities of the hind-quarters. The tail is extremely short, and the general colour of the coat yellowish brown, with rings of different colours on the hairs. The mandrill is of the size of a mastiff. The drill, on the other hand, is a rather smaller and less powerful baboon, with the bare parts of the face and buttocks slate-coloured, and the individual hairs of the coat uniformly coloured; the tail is also rather longer than that of the mandrill.

In immature males of the mandrill the face is black, while in females of all ages it is blue, this sex also showing a much smaller development of the swellings on the nose. Of the habits of the mandrill in the wild state little is known. It apparently, however, associates in large companies, like the dog-faced baboons, and is a dangerous enemy on account of its strength and size, although probably it does not attack human beings without provocation, thereby differing from its relatives. Mandrills are often brought to Europe, especially when young; and in captivity grow sulky and malicious with increasing age. If intending defiance, they beat the ground with one hand; if wishing to be amiable, they turn their brilliantly coloured hind-quarters to visitors; this being also done by young males in which the colours are not yet developed. If well treated, these baboons will learn a variety of tricks, and some have even become celebrated for their cleverness in this line.

Pottos and Awantibos.

Very characteristic of the West African tropical forests are two remarkable creatures allied to the lemurs of Madagascar, but forming a group by themselves. These are the potto (*Perodicticus potto*) and the awantibo (*Arctocebus calabarensis*). The typical representatives of these two genera, often distinguished as Bosman's potto and the Calabar awantibo, were long regarded as the sole representatives of their kind, and of the second only a very few examples had found their way into collections. In 1879 a potto from the Gabun was, however, described by a French naturalist as a distinct species, on account of its larger size, longer head, shorter tail, and greyer tone of colouring; and in 1902 an English writer added to each genus a species from the French Congo. Both pottos and awantibos—which are known to British residents on the west coast as sloths—are not much larger than a big squirrel, and are characterised by their rudimentary tails and the abortion of the index finger. Awantibos differ from pottos by the structure of the hand, the fuller development of the cheek-teeth, the absence of a projecting ridge on the skull above the aperture of the ear, and of projecting processes on the upper surface of the vertebræ of the neck. In the pottos, which possess such processes, these project through the skin so as to form a series of knobs or tubercles of bone down the middle of the back of the neck.

The Congo potto (*P. batesi*) is intermediate in size between the other two western species, and is also of a richer and more rufous tone of colouring, the tint of its fur being almost that of red mahogany. A third species, *P. ibeanus*, inhabits Uganda, and is of particular interest as demonstrating that the group extends right through the equatorial forest-zone, instead of being restricted, as was long supposed to be the case, to the west coast. The Congo awantibo (*A. aureus*) differs from the Old Calabar species by its smaller size, still shorter tail, in which the terminal hairs are stiff and closely pressed together, and the bright golden colour of the fur, which has no black tips to the hairs.

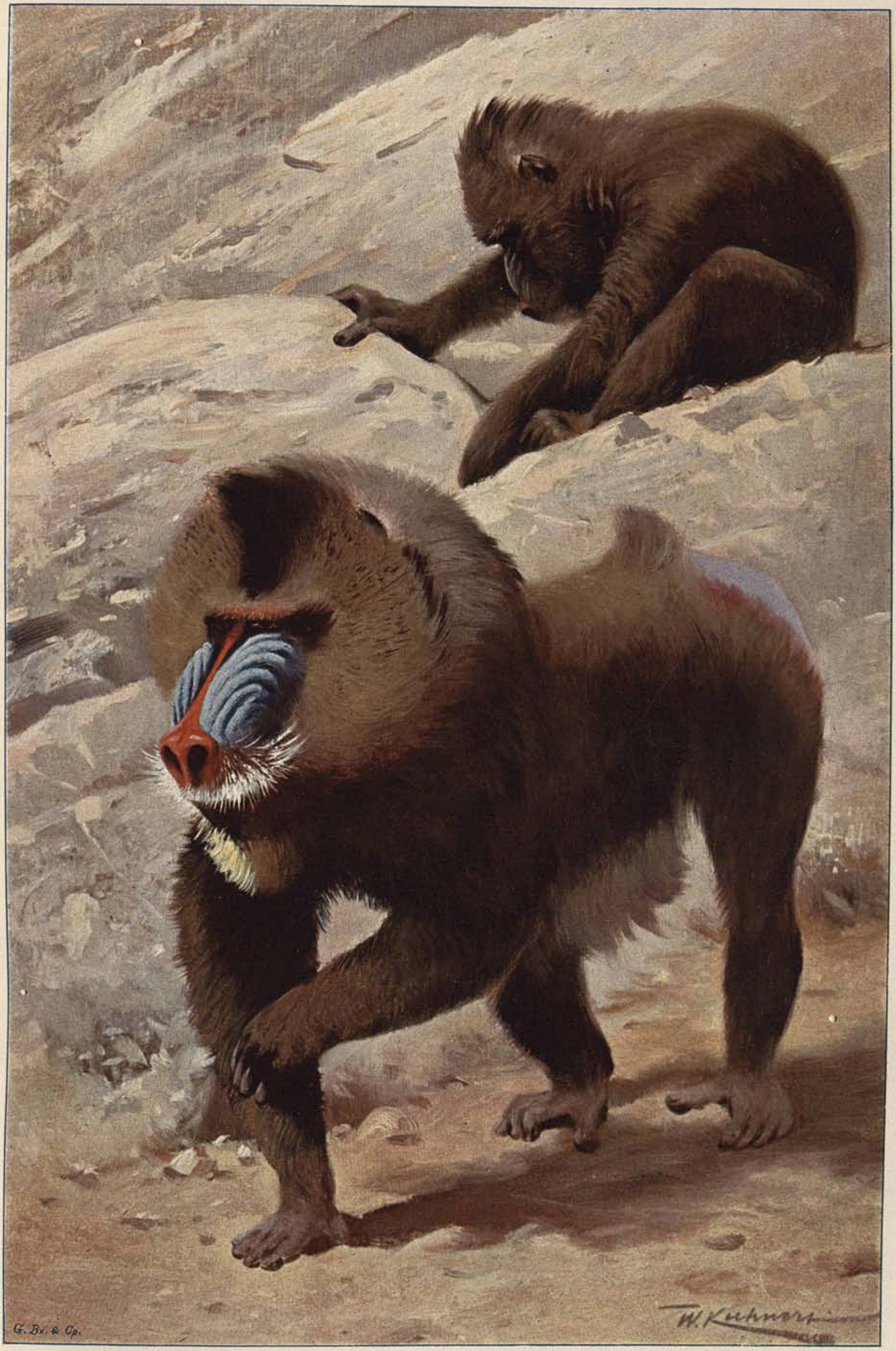
Both pottos and awantibos lead a completely arboreal and nocturnal existence, sleeping during the day curled up into the shape of a ball, with their heads buried between their arms. These weird creatures appear to be the African representatives of the lorises, or slow-lemurs, of India and the Malay countries.

Galagos.

Another group of lemur-like animals—also popularly known as sloths—restricted to the forest-regions of Africa are the galagos, all of which are comparatively small creatures, some being no larger than rats. They are easily recognised by their large and naked ears being capable of folding, so as to lie quite close to the sides of the head. Their soft and thick fur is either grey or brownish; and they have the curious habit of sitting up on their hind-quarters with their arms extended at right angles to the body in the attitude of a man who is "buffeting" in order to warm himself.

When on the ground, galagos sit erect and progress by leaps, but never walk. They are stated to resemble the Malagasy mouse-lemurs in their habit of making nests in the forks of trees, this being especially the case with the smaller kinds, several individuals of which frequently occupy one nest at the same time.

The great galago (*Galago crassicaudata*), which inhabits the lower Zambesi valley and the east coast generally as far as the 24th degree of S. latitude, is of the approximate size of an ordinary cat, and of a uniform brown colour. It



MANDRILL.

appears to be restricted to the coast-district, never going beyond the mangrove-belt bordering the shore. The leaves of the cocoa-palm form its sleeping-place; and when startled, it will leap from the crown of one palm to another. The natives capture these galagos by leaving calabashes of palm wine on the trees, by drinking which the little creatures become intoxicated and helpless.

WHITE-TAILED GALAGO.

Professor F. B. Loomis is of opinion that lemurs, of which the earliest known representatives are the Lower Eocene *Anaptomorphidæ* and *Notharctidæ*, originated in the forest tract north of Hudson Bay, which then enjoyed a tropical climate. From this ancestral centre the first Primates, along with other groups, migrated by three paths, one south into America, a second to England and France, and a third to Asia, and thence southerly across China and India, and along the Indo-Madagascar isthmus to Madagascar and Africa. At an early date the group became differentiated into fruit-eaters —*Anaptomorphidæ*—followed by the modern *Tarsiidæ* and general feeders —*Notharctidæ* — which gave rise to the tropical American *Cebidæ* and the extinct European *Adapidæ*, from which are derived the Old World apes and monkeys, while a side-branch gave rise to true lemurs.

In Angola the genus is represented by Monteiro's galago (*G. monteiri*), which is slightly larger, and, instead of dark brown, pale grey in colour, with the sides of the nose somewhat darker, and the throat and tail nearly or entirely white. Other members of the group are *G. garnetti* of the east coast, *G. senegalensis*, which was the first species to be brought to Europe, *G. alleni* from the Gabun, *G. demidoffi* of central Africa, and the white-tailed *G. lasiotis*, and *G. moholi*, whose range extends from Angola through Rhodesia, the Transvaal, and Nyasaland to the east coast.

Bats.

One of the features of the fauna of continental Africa is the absence of flying-foxes of the typical genus *Pteropus*, this absence extending also to the island of Zanzibar. On the other hand, representatives of these bats occur in Madagascar and the Mascarene, Comoro, and Seychelles groups. In 1909, however, specimens of a new species of flying-fox were obtained from the island of Pemba, which lies to the north of Zanzibar at a distance of only about 37½ miles from the mainland. That the genus should be found so close to the African continent, and yet should never have reached the same, is very remarkable, especially when the long interval between the Comoros and Seychelles, on the one hand, and the Andamans and Ceylon, on the other, is borne in mind. The Pemba species belongs to the short-nosed group of the genus distinguished as *Spectrum*, and has been named *Pteropus voeltzkowi*.

In addition to being the home of the great hammer-headed bat (*Hypsignathus monstrosus*) of the forests of the west coast, one of the most hideous and repulsive-looking of the whole order, and characterised by the presence of a kind of shield on the large and horse-like muzzle, equatorial Africa is inhabited by a group of fruit-eating bats collectively known as epauletted bats. These bats take their name from the circumstance that the males of the majority of the species are furnished with large glandular pouches in the skin of the sides of the neck near the shoulders, from the apertures of which project tufts of long, coarse, yellow hairs. Formerly all these bats were included in the single genus *Epomophorus*. Anchieta's fruit-bat, *Plerotes anchietæ*, of the Benguela district, has, however, been shown to represent a distinct generic type, which in some degree serves to connect the more typical kinds with the hammer-headed species and the short-tailed African flying-foxes of the genus *Rousettus*, or *Xantharpyia*. In place, for instance, of having only $\frac{3}{5}$ pairs of cheek-teeth like the typical epauletted bats, it has $\frac{4}{6}$ pairs, and is thus only a step from *Rousettus*, in which the number is $\frac{5}{6}$, *i.e.* 5 upper and 6 lower. In addition to this, it is characterised by the great width of the palate, which exceeds that of all the other members of the group, as well as that of *Rousettus*. The next generic representative of the group is *Epomops*, as represented by *E. franqueti*, *E. comptus*, and *E. buettikoferi*, which agrees with *Epomophorus* in the number of its teeth, but has a broad palate flattened behind, as in *Rousettus*. In marked distinction to this, is the narrow and posteriorly hollowed palate of the typical genus *Epomophorus*. In this respect *Epomops* and *Epomophorus*, both of which feed on soft, ripe fruits, especially figs, have followed essentially different lines of development in adapting themselves to a special kind of diet. Another generic representative of the group is *Micropteropus*, easily recognised by the extreme shortness of its skull, which approximates to that of the Asiatic genus *Cynopterus*.

The remaining generic representatives of the exclusively Ethiopian epomophorine section are *Nanonycteris*, with a single west coast species ranging from Liberia to southern Nigeria; *Scotonycteris*, with one species from the island of Fernando Po, and *Casinycteris*, likewise with only a single species, which inhabits the Cameruns.

Of the group typified by the Oriental *Cynopterus*, Ethiopia possesses one generic representative, *Myonycteris*, with four western species, one of which

(*M. brachycephala*) is restricted to the Isle of St. Thomas, in the Gulf of Guinea.

All the foregoing fruit-bats belong to the typical subfamily *Pteropodinæ*; a second subfamily, the *Macroglossinæ*, which is mainly Asiatic and Australasian in distribution, is represented in Ethiopian Africa by a single western species, *Megaloglossus woermanni*, which is the sole member of its genus.

Among the insect-eating section of the order (Microchiroptera), tomb-bats of the widely spread genus *Taphozous*, belonging to the free-tailed group (*Emballonuridæ*), are well represented in Africa.

In view of the remarkable affinity existing between certain African and South American rodents (which are quite distinct from those of any other part of the world), to say nothing of the relationship between the mud-fishes of the two continents, it is interesting to find that a South American type of bat occurs in West Africa. When first described, this bat was referred to a common African genus, but on re-examination it has been found, from the nature of the teeth and other characters, to be nearly related to the American mastiff-bats (*Molossus*, etc.), which are chiefly found in Central and South America. The African species, however, indicates a genus by itself, and has been named *Eomops whiteleyi*. A second African representative of the *Molossinæ* (or *Molossidæ*, as they are now often termed) is *Platymops macmillani*, from the district between Adis Ababa and Lake Rudolf, which is the sole representative of its genus. It is distinguished from its relatives the mastiff-bats by the absence of wrinkles in the lips and the curiously flattened head. Whether these bats serve in any way to confirm the theory of a former land-connection between Africa and South America is doubtful. If their ancestors were blown across the Atlantic from the west the question must be answered in the negative; as it must also be if we assume that the progenitors of the African and the South American mastiff-bats were natives of the Northern Hemisphere.

Special mention may also be made of Welwitsch's bat (*Myotis welwitschi*), remarkable for its brilliant coloration. On the upper surface this bat is reddish, while below it is pale yellow with the bright orange-yellow membrane between the legs margined with black and dotted with small sable spots. This species appears to be confined to Angola. Another noteworthy species is the butterfly-bat (*Chalinolobus variegatus*) of Damaraland; while the Bourbon bat (*Scotophilus borbonicus*) is likewise worthy of mention as a tri-coloured species. The genera to which both these species belong are widely distributed. With the bare mention that the genus *Nycteris* is common to the Indian and Ethiopian regions, these brief notes on African bats must be brought to a conclusion, as the subject is much too large for anything approaching a complete summary.

Insect-Eaters.

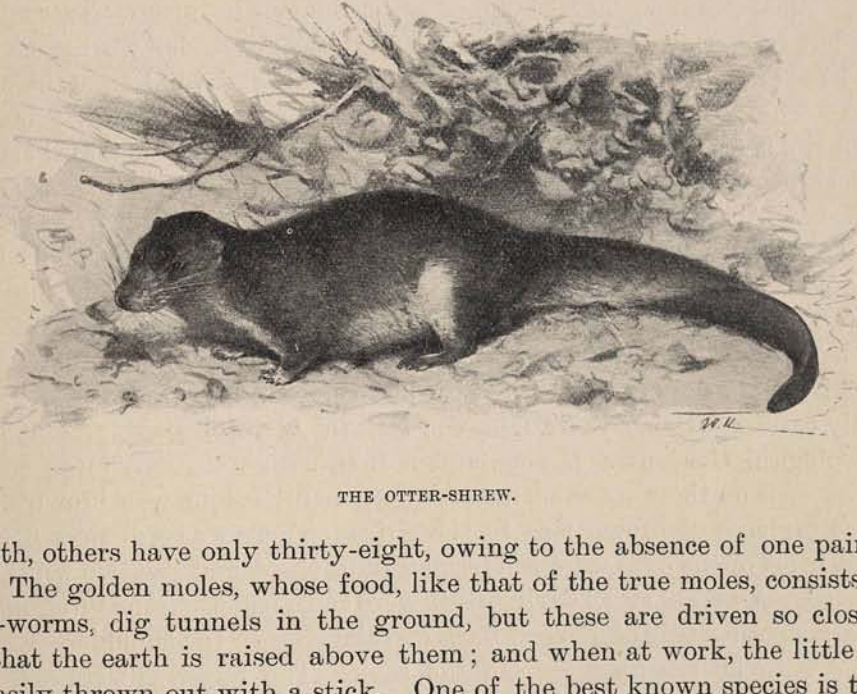
The order of insect-eating mammals is represented in Ethiopian Africa by a number of altogether peculiar generic types, as well as by a few common to other parts of the world. Among the latter is the white-bellied hedgehog (*Erinaceus albiventris*), a species distinguished by the absence of the first toe of the hind-foot, although traces of its claw remain. Of the jumping-shrews, which have been mentioned in the preceding chapter as forming a family-group (*Macroscelididæ*) peculiar to the African continent, there are a number of representatives on the eastern side; the majority being referable to the typical genus *Macroscelides*. These jumping-shrews appear to represent in Africa the tree-shrews, or tupais of Asia. Many species are five-toed, but others are characterised by lacking the first toe of the hind-foot, on which account they are regarded by many modern naturalists as representing a distinct generic type, under the name of *Petrodromus*, the typical representative of this section being the eastern *M.* (*P.*) *tetradactylus*. Largest of all are the giant jumping-shrews of East Africa, of which the black and chestnut *Rhynchocyon petersi* and the olive-coloured and light-spotted *R. cernaysii* are well-known examples. In this genus the trunk is longer and the hind-feet are relatively shorter than in typical jumping-shrews, the number of toes being four to each foot.

JUMPING-SHREW.

One of the most remarkable of the African insect-eaters is the otter-shrew (*Potamogale velox*), which represents a family by itself. This animal, which measures about 18 inches in length, was long supposed to be peculiar to the west coast, but has been recently discovered on the eastern side of the forest-zone in the neighbourhood of the Semliki. In general appearance it may be compared to a miniature otter; but the resemblance is mainly restricted to the flattened head, elongated body, short limbs, and the long and greatly compressed tail. The otter-shrew was discovered by du Chaillu, and long regarded as very rare. It inhabits the borders of rivers, and in its mode of life is very similar to an otter, although its food doubtless consists of insects, molluscs, and other invertebrates. In colour it is brown above and white below.

Another very characteristic African family group of insect-eaters is formed by the golden moles (*Chrysochloridæ*), many of which are recognisable at a glance by the peculiar metallic iridescence of their fur. They are confined to central and southern Africa, and although somewhat mole-like in appearance, and more so in habits, are most nearly related to the otter-shrew and the tenrecs of Madagascar.

In all the golden moles the eyes are completely buried in the thick skin, the tiny ears are hidden in the dense fur, and the middle pair of toes of the four-toed front-feet are furnished with powerful curved claws, well adapted for digging. Their fore-feet are thus quite different from the spade-like hands of the true moles—a group which is entirely absent from Africa. While some of the golden moles have forty teeth, others have only thirty-eight, owing to the absence of one pair of premolars. The golden moles, whose food, like that of the true moles, consists mainly of earth-worms, dig tunnels in the ground, but these are driven so close to the surface that the earth is raised above them; and when at work, the little animals can be easily thrown out with a stick. One of the best known species is the Cape golden mole (*Chrysochloris aurea*), of Cape Colony and the neighbouring districts.



THE OTTER-SHREW.

Of great interest in connection with the golden moles is the occurrence in the middle Tertiary deposits of North America of remains of two extinct genera (*Xenotherium* and *Arctoryctes*) of apparently nearly allied Insectivora. These, as mentioned in the first chapter of the present volume, discount the value of the allied extinct Patagonian genus *Necrolestes* in regard to a former connection between Africa and South America, although, as mentioned in the same chapter, such a connection seems to be demonstrated by other lines of evidence.

Lion. Some part of Ethiopian Africa is the home of the typical race of the lion (*Felis leo typica*), although the precise habitat of this race of the species cannot be identified. In colour it is yellowish red, and has no mane on the belly. Among several races that have been named, the Cape lion (*F. l. capensis*) is characterised by its dusky yellow colour, and the extension of the mane on to the under-parts; the ears being unusually long and thick.

The Senegal lion (*F. l. senegalensis*) is a medium-sized race of a reddish brown colour, with a feeble development of mane, which is wanting on the shoulders, and ends in a point on the withers. The lion of the Cameruns and Adamawa districts, which has been distinguished as *F. l. kamptzi*, is characterised by its ochery back, the dun under-parts, and yellow mane. Of the remaining races, it must suffice to mention the Masai lion of East Africa (*F. l. masaica*), which is remarkable for retaining the spots, at any rate in some instances, in the adult.

In connection with spotted lions, the following is of considerable interest:—

In the Museum of Antiquities at Berlin is preserved an ancient mosaic from Marefoschi, in Mesopotamia, representing a combat between centaurs and lions. Behind one of the centaurs is depicted a dying lion with a profuse mane, while in the background is a second lion crouching. A third is lying on a fallen centaur. This last animal has the general build of an ordinary lion, although strongly made in front, but falling away on the hind-quarters, where it shows distinct striping. Narrow bands are also shown on the flanks, the fore and hind legs, the neck, and the loins. The tail, which, like those of the other lions in the group, has a thickened tip, is also barred in its basal half. The characteristic dorsal crest of the tiger is lacking. In the lion standing in the background distinct spots are shown on the body. According to a German naturalist, the stripes are too sparse and narrow for a tiger, while the general form of the animals is essentially lion-like. That the ancient artists were true to nature is demonstrated by a mosaic from Hadrian's villa at Tivoli in the Berlin Museum, which represents the chita or hunting-leopard with its characteristic solid spots correctly delineated. That the Marefoschi mosaic does not represent a lion-tiger hybrid may be regarded as practically certain. Some years ago, the Sultan Abdul Hamid presented to the Berlin Zoological Gardens a Mesopotamian lion, with unusually large ears and a large black spot on their outer surface. The general colour was brownish tawny, due to the presence of brown tips to the hairs. There was a distinct dark dorsal stripe; in front of the eyes were the normal light spots, and also two white spots on the forehead. A pair of small dark stripes were conspicuous on the forehead in front of the ears, another pair of narrow dark streaks crossed the shoulders, while there were eight more on the hind part of the back. The fore-legs were marked with brownish red spots, as were likewise the light-coloured under-parts. In addition, a narrow dark bar was developed on the inner side of the thighs, which were likewise barred on the outer surface. Unfortunately, the Mesopotamian lion is now verging on extinction, but the evidence of the Berlin specimen, taken in conjunction with the Marefoschi mosaic, suggests that for the last two thousand five hundred years it has, in many instances at least, been striped.

As the habits of lions have been discussed at considerable length in the preceding chapter, no further mention is necessary in this place.

Leopard.

A similar remark will apply in the case of the leopard, although some reference must be made to the local races and varieties. Some of the East African leopards, which have been described under the names of

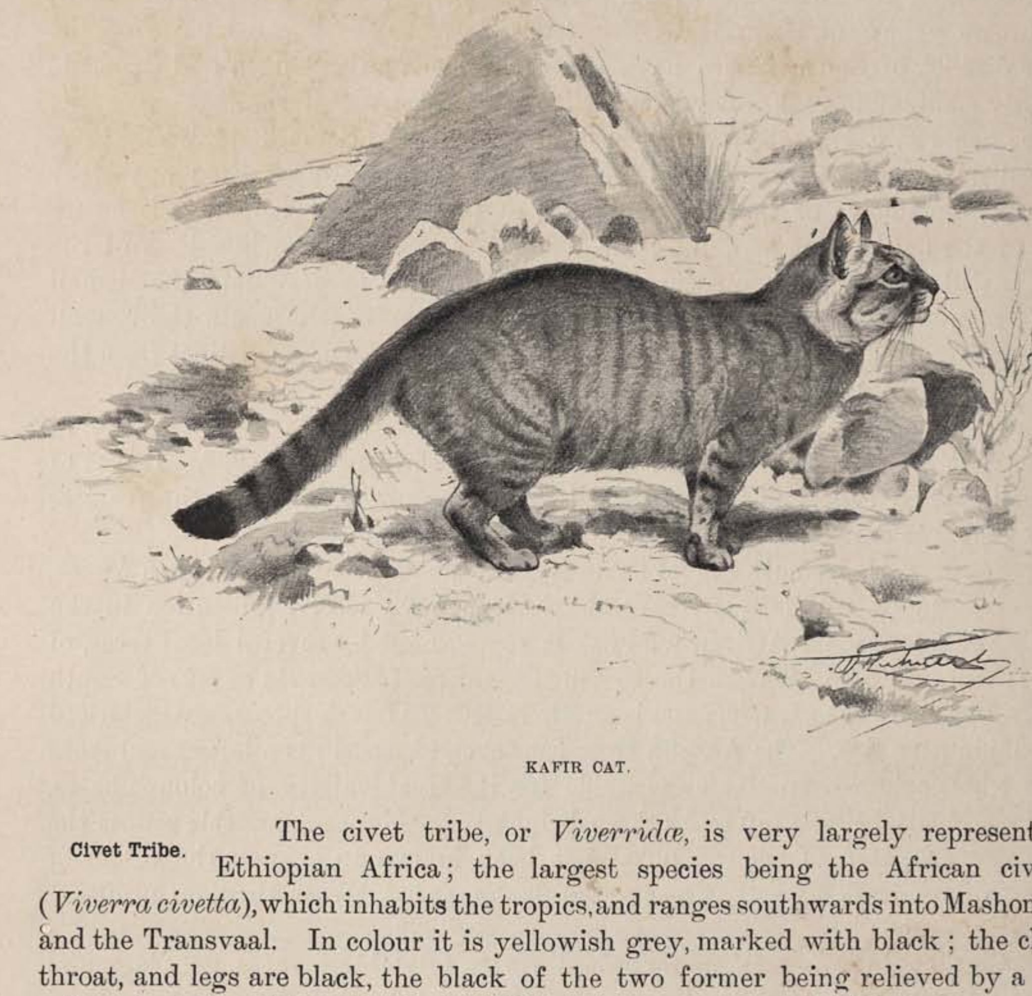
F. pardus suahelica and *F. p. ruwenzorii*, have large rosettes like those of Persian and Indian leopards; and it appears to be among leopards of this type that wholly black individuals are occasionally found in Abyssinia and East Africa.

The majority of African leopards, such as *F. p. leopardus* of West Africa, are, however, characterised by the spots being small and numerous, as well as by those on the head and fore-part of the body not being arranged in rosettes. These simple, solid spots are not unfrequently continued down the middle line of the back, while those on the limbs are also mainly of the same type. While leopards with this type of markings from more or less open country have a light golden tawny ground-colour, passing into white on the under-parts and inner surfaces of the limbs, those from the moist tropical forests display a darker ground-colour, with tawny yellow under-parts. Other leopards from the wooded parts of the Albany district of South Africa have the ground-colour very dark and the spots extremely small and evenly distributed, with but little trace of rosettes. For this type the name *F. p. melanosticta* has been suggested. In Somaliland, where lions run smaller than the average, the leopard is also much smaller than any other known representative of the species. It is, in fact, a pigmy leopard, the entire length of the flat skin of an adult male being less than 6 feet, while that of the female is still smaller; it has accordingly been proposed to designate the Somali race *F. p. nanopardus*. In coloration and the form of the spots the Somali animal corresponds to the ordinary African type of leopard, as distinct from the large-spotted East African and Indian races.

The skin of a white leopard of rather diminutive size from Dar-es-Salam, in German East Africa, was exhibited at Berlin in the early part of 1909. It was of the small-spotted type, and was described as being pure white, with the rosettes faintly visible as dark markings.

Smaller Cats. Brief notice must suffice for the smaller cats of Ethiopian Africa, more especially as several of these have received mention in the preceding chapter. The African wild cat is represented by several local races, of which it will suffice to mention the so-called Kafir cat (*F. ocreata caffer*) of South Africa. Burchell's cat (*F. nigripes*) is another South African species characterised by its diminutive size. The African tiger-cat (*F. celidogaster*) is a larger and more or less whole-coloured species remarkable for its great variety of colour-phases, some individuals being grey and others bright red. More remarkable still is the fact that a specimen of the red phase has been known to change the colour of its fur to dark dusky grey. The species is somewhat larger than an ordinary domesticated cat.

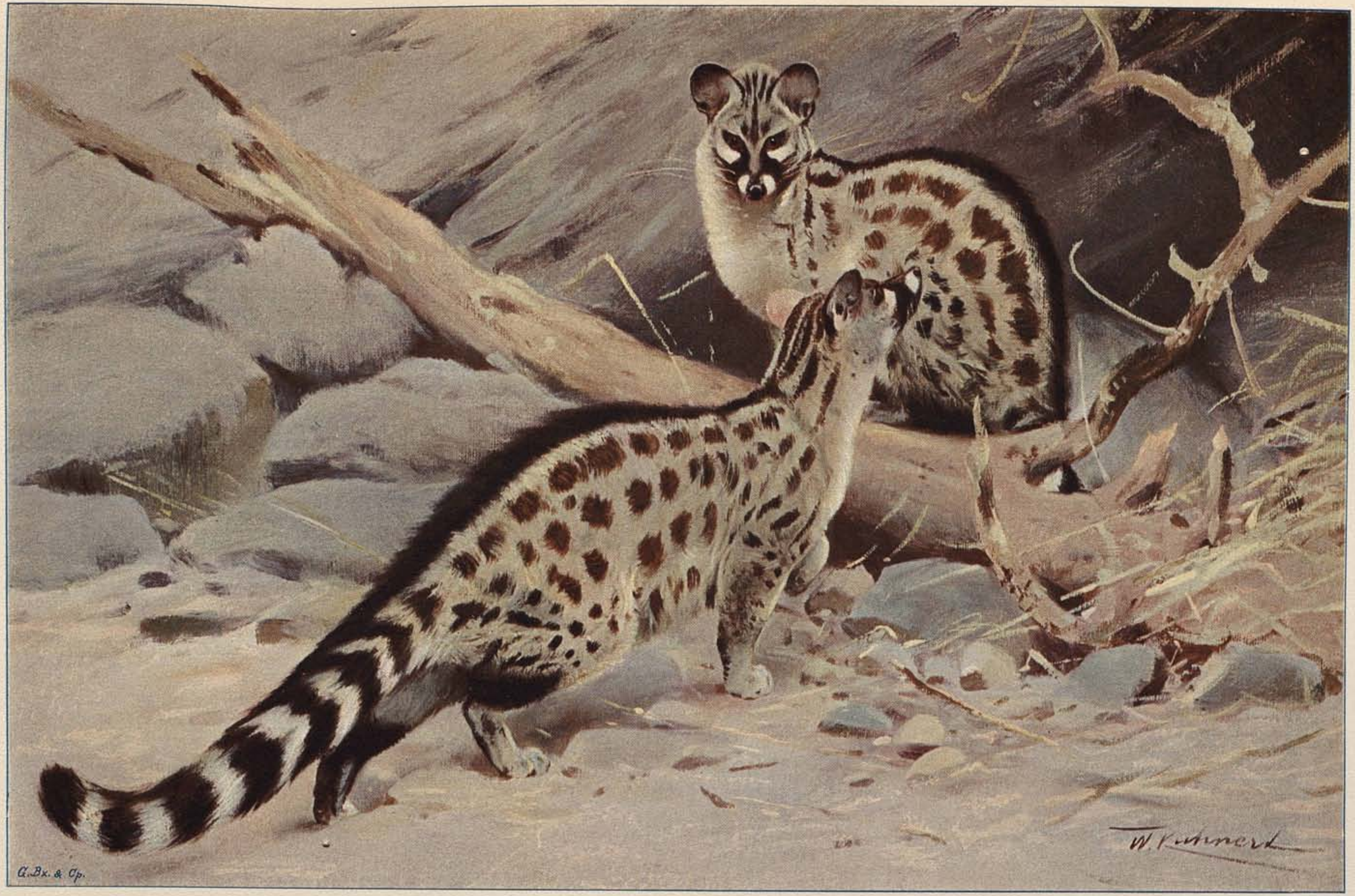
Of the serval (*F. serval*), characterised by its solid black spots, long legs, and short tail, there are several local races; an allied species being the small-spotted serval (*F. servalina*), which, under several local forms, ranges from the forest-districts of the west coast to Uganda. The wholly rufous caracal, or red lynx (*F. caracal*), and the hunting-leopard (*Cynælurus jubatus*) are, as mentioned in the preceding chapter, to be met with, in suitable localities, all over Africa. Till 1911 the hunting-leopard was generally regarded as a primitive member of the cat tribe; but in that year the opinion was expressed that it is closely allied to the more typical cats, the puma and the lynx, whereas lions, tigers, leopards, and jaguars are as markedly different. This conclusion is largely based on the fact that in the former group the hyoid apparatus of the tongue is intimately connected with the skull, and that these animals purr instead of roaring. In the second group, on the contrary, the hyoid is suspended to the skull by means of a pair of long elastic cartilages, and this structure is connected with the power of roaring. The partial retractility of the claws of the chita is regarded as an adaptive feature connected with speed, for which this animal is specially built. It may be mentioned that in India the name chita (meaning spotted) is applied indifferently to the leopard and to *Cynælurus jubatus*, for which reason "hunting-leopard" is a preferable designation for the latter.



KAFIR CAT.

Civet Tribe. The civet tribe, or *Viverridæ*, is very largely represented in Ethiopian Africa; the largest species being the African civet-cat (*Viverra civetta*), which inhabits the tropics, and ranges southwards into Mashonaland and the Transvaal. In colour it is yellowish grey, marked with black; the cheeks, throat, and legs are black, the black of the two former being relieved by a broad collar of white. Along the back of the males runs an upright black crest or mane. In habits this civet is as nocturnal as the rest of its tribe. There are also several kinds of genets, although the distinctive features of the various species or races are difficult to describe. A common species is the blotched genet (*Genetta tigrina*); and very distinct is the large and handsomely coloured *G. victoriæ* of the Uganda Protectorate.

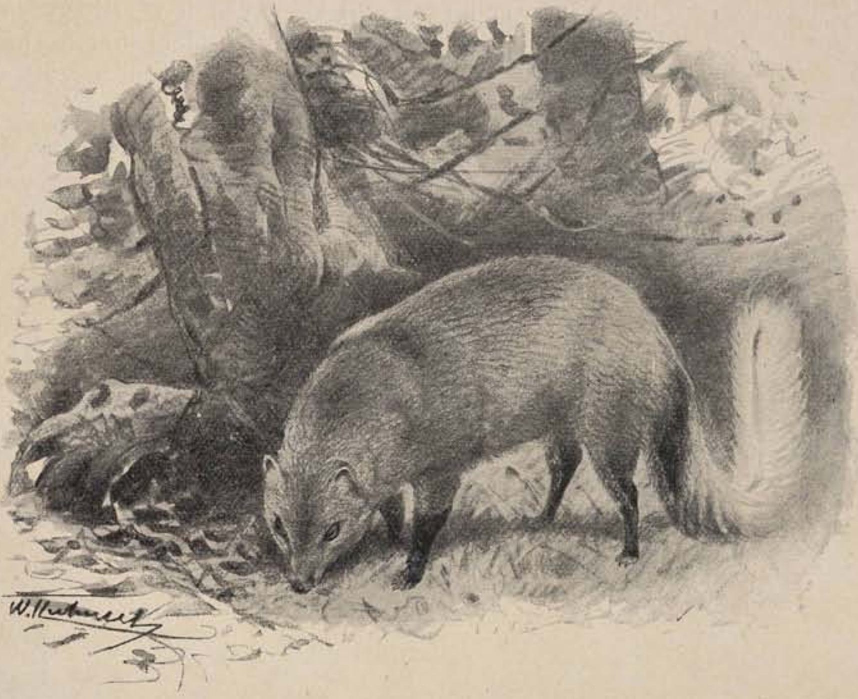
The African linsang (*Poiana poënsis*) is a western species, from Sierra Leone and Fernando Po, which represents in Africa the true linsangs of the Malay



DONGOLA GENET.

countries. It has a bare strip on the sole of each hind-foot, and is marked with spots, which are not arranged in distinct lines, and the dark rings on the tail are alternately broad and narrow; these characters being regarded as sufficient to justify the generic separation of the African animal from the true Asiatic linsangs.

The Asiatic palm-civets are represented by two species of an allied genus; one of these being the West African palm-civet (*Nandinia binotata*), which inhabits Ashanti, Fernando Po, and Angola, but also extends into east central Africa. Its reddish grey coat is typically spotted with black, and there are three streaks on the neck. In Nyasaland it is replaced by the species, or variety, known as Gerrard's palm-civet (*N. gerrardi*), in which the black spots are smaller and fewer and the dark streaks on the neck absent. In habits these species are thoroughly arboreal and nocturnal; their food probably consisting of birds and small mammals. *Nandinia* is considered to be a very primitive type of the civet family.



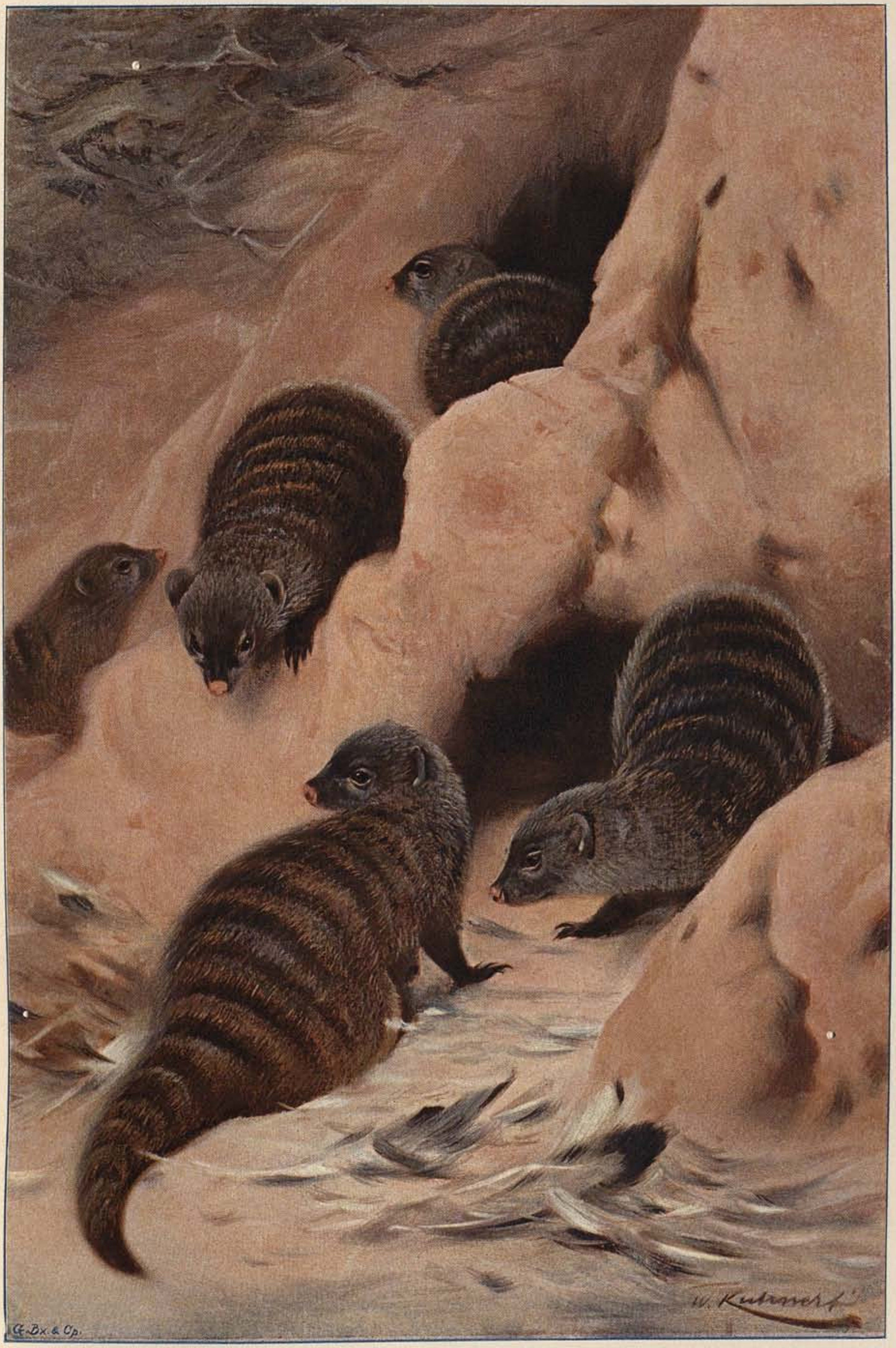
WHITE-TAILED MONGOOSE.

The mongooses and their allies have likewise numerous African representatives. Among them are the long-nosed mongoose (*Herpestes naso*) of West Africa, and the white-tailed *H. albicauda*, ranging from Guinea and Nubia down to Cape Colony, and also reappearing in Arabia as far east as Muscat. In length the latter slightly exceeds 38 inches, of which the tail occupies about 16 inches. Still larger is the giant mongoose (*H. grandis*), first described from the skull alone. The large grey mongoose (*H. caffer*) is distributed all over Africa south of the Sahara; while the slender mongoose (*H. gracilis*) ranges from Cape Verde to Abyssinia, and thence down the eastern side of the continent into Cape Colony. Another kind, the water-mongoose (*H. galera*), is widely distributed north of the equator, and is also common to the south of the Zambesi. The bushy-tailed mongooses, of which two species, *Cynictis penicillata* and *C. selousi*, are known, are South and East African. The cusimanse (*Crossarchus obscurus*) is the western representative of a more numerous and more widely spread African genus of the group, of which the banded mongoose (*C. fasciatus*) is another member. The five-toothed mongoose (*Helogale parvula*), of West and East Africa, forms another genus, doubtfully distinct from *Herpestes* itself. Very distinct are the four-toed mongooses, as represented by *Bdeogale nigripes*, of West, and *B. crassicauda* and *B. puisa* of East Africa. Yet another generic type is formed by *Rhynchogale melleri* of East Africa, a large red species, with five toes to each foot, and the lower surface of the upper part of the hind-feet hairy. Finally, we have the well-known meerkat (*Suricata tetradactyla*) of the Orange River Colony, the Transvaal, and Cape Colony. In this pretty little animal the limbs are four-toed, and the claws of the fore-feet double the length of those of the hind-pair, while the number of the teeth is thirty-six. The muzzle is elongated, the black ears are carried close to the head, a black patch surrounds each eye, and the general colour is grizzled grey. The meerkat dwells in large colonies on the karu, where it digs its own burrows; and it is a favourite animal as a pet, soon learning to follow its master like a dog.

MEERKAT.

Aard-Wolf.

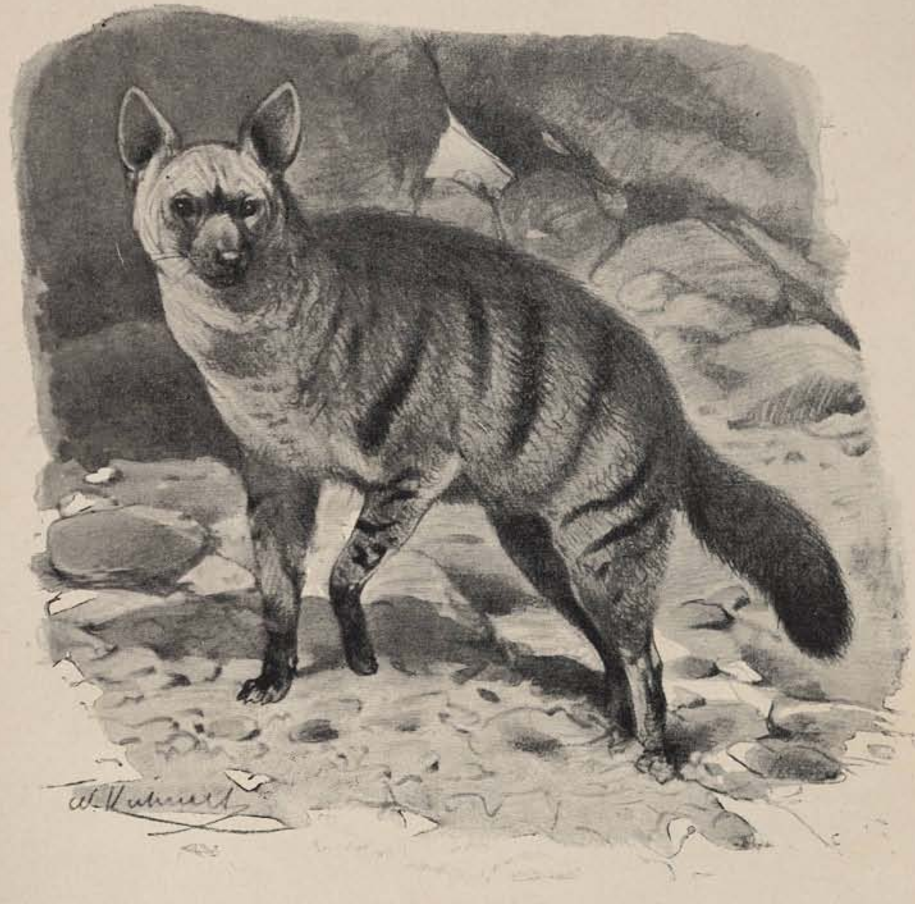
In some degree connecting the civets with the hyænas, the aard-wolf (*Proteles cristatus*) is an altogether peculiar African animal, whose range extends along the east coast from Somaliland to Cape Colony, and on the western side at least as far north as Angola. Externally this remarkable animal much resembles a small narrow-striped hyæna, but is distinguished by its longer ears, more pointed muzzle, and the presence of five toes on the fore-feet. In several other respects it differs so markedly from the hyænas as to justify its reference to a family group by itself. Several local races of aard-wolf, or maned jackal, as the creature is called in the Transvaal, are now recognised. In habits aard-wolves are nocturnal. During the daylight hours they sometimes sleep in



BANDED MUNGOOSE.

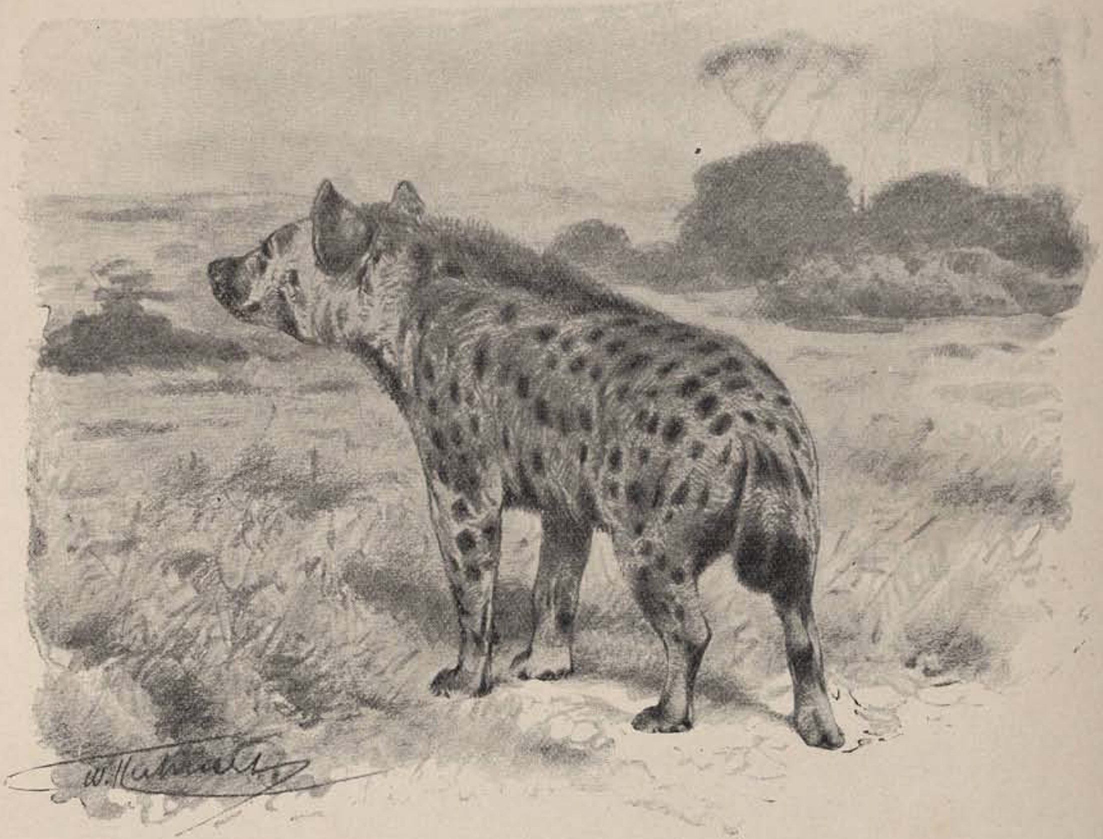
thickets, but more generally resort to a hole, using as a rule burrows made by ant-bears, although occasionally excavating earths for themselves. Their food appears to consist chiefly of insects, especially white ants, but they are reported to eat carrion, and to kill kids and lambs for the sake of the milk in their stomachs. The feeble character of their teeth will not permit them to attack larger animals.

Hyænas. As previously mentioned, the striped hyæna is represented in East Africa by a local race (*Hyæna striata schillingsi*). Nearly allied is the brown hyæna, or strand-wolf (*H. brunnea*), a species confined to the south-west, but now very rare in Cape Colony, and unknown in Natal. This species is distinguished by the mantle of long, coarse hair hanging down from the sides of the neck and back, the short, bushy tail, the long, pointed ears, and the general brown colour, marked on the legs with light brown or whitish spots, the face being greyish brown, and the crown of the head black with whitish or reddish brown flecks. A very distinct type is the spotted hyæna (*H. crocuta*), which ranges across the continent from Senegambia to Somaliland and southwards to Cape Colony, where it was formerly common even in Cape Town itself. Measuring about 54 inches to the root of the tail, the spotted hyæna is one of the most ugly and repulsive-looking of all Carnivora. It is also larger than the other hyænas,



AARD-WOLF.

from which it is further distinguished by the greater relative length of its hind-legs, as well as by its shorter tail, smaller and more rounded ears, the absence of a mane and its peculiar coloration. At the present day it is an exclusively African species, of which several local races are now recognised by naturalists. The general colour is yellowish brown marked with large brown spots. The spotted hyæna is much fiercer and more prone to attack living animals than the striped species. During the Abyssinian war it was constantly prowling among the tents and attacking mules, ponies, cattle, and goats; and in the Kilimanjaro district it has the reputation not only of carrying off sheep and calves, but even children, and also of attacking wounded or exhausted coolies. Some of these hyænas are indeed sufficiently courageous to enter tents at night, although they retreat at the slightest suspicion of danger, when they are as cowardly as they are bold at other times. In south-east Africa the species is reported to be more common at the present day than in former days, when it depended for food chiefly upon prey abandoned by lions, whereas it can now obtain the carcases of wounded animals which perish in the jungle.



SPOTTED HYÆNA.

Dogs, Jackals, and Fennecs. No true wolf is known in Africa south of the Sahara, the cuberow, or so-called Abyssinian wolf (*Canis simensis*), being, according to recent accounts, much more like a large fox, both in habits and appearance. Certainly its skull is very unlike that of a true wolf. It takes its name from the district of Simen in the mountainous parts of Abyssinia, where it lives on ibex and other game. In colour it is pale yellowish, or reddish brown, with the under-parts and the front of the lower portion of the legs whitish, and black mottlings on the upper surface of the black-tipped tail.

The range of the black-backed jackal (*C. mesomelas*) includes Angola, South and Central Africa, Somaliland, and central Nubia. This extremely handsome species differs from the North African jackals by the brilliant coloration of both sexes. Brownish red is the prevalent tint on the sides of the body and limbs, but the whole back is black mingled with white or grey hairs, and the tail-tip is also black, the under-parts and inner sides of the legs being almost white. This long-eared jackal measures about 53 inches in length, inclusive of the tail, which is very bushy, and about 14 inches long. In several of its habits it resembles a fox; sleeping during the day in thick covert, and hunting by night, when it inflicts much damage on flocks in the settled districts. In the wilder parts of the country its chief prey includes the smaller kinds of antelopes and various rodents. The cubs are born in a burrow, frequently that of an ant-bear, from which the rightful owner has been ejected. The black-backed jackal is the only member of the group in which the front of the fore-legs is not marked with black splashes. Nearly allied is the side-striped jackal (*C. adustus* or *C. lateralis*), which ranges over a large area in central and South Africa, extending from the Gabun to Kilimanjaro, and occurring also in Angola, Nyasaland, Rhodesia, and the western Transvaal. Of rather stout build, this species is distinguished by a long, fox-like muzzle, and the presence of a light irregular stripe or stripes along the flanks. In general colour it is silvery grey, rather darker on the back, and passing into rufous on the limbs. Its habits are those of jackals generally. Some modern naturalists recognise several other African jackals, but most of these, at any rate, are best regarded as races rather than species.

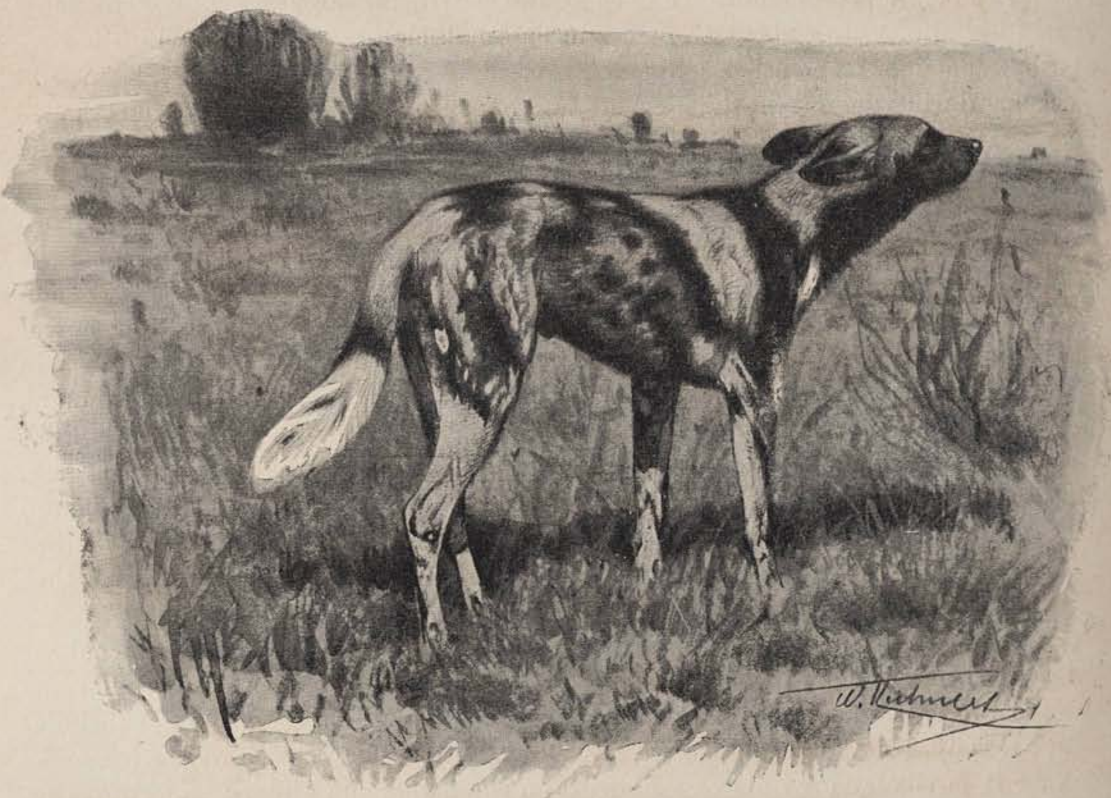
Of a totally different type is the kama fox or fennec (*C. cama*), an animal somewhat smaller than the European species, with longer ears, and therefore in some respects intermediate between the true foxes and the fennecs. Its range includes Cape Colony, Natal, the Orange River Colony, and German South-west Africa. In colour it is silvery grey above, yellowish on the flanks and under-parts, rufous on the head, and brown on the muzzle; the fur being soft and thick, and the long tail very bushy. As this fox feeds chiefly on insects and fruits, it is not molested by the colonial sheep or poultry farmers.

In connection with these animals feeding on a diet of this nature, it may be mentioned that an Indian jackal killed on the shores of Lake Tamblegam, Ceylon, in August 1911, was found on dissection to have its stomach distended with a great mass of winged white ants. These insects had been emerging from the nests in great numbers for two or three days previously in the neighbourhood, and the jackal had evidently made a hearty meal off one of the swarms. It has long been known that Indian jackals will feed greedily on fruit, but there appears to be no previous reference to white ants or others insects forming part of their diet.

Another species, the pale fox (*C. pallidus*), a native of Senegambia, Nubia, and Kordofan, is inferior in size to the last, but has relatively larger ears. In most cases its colour is pale yellow with a slight reddish tinge, the upper surface of the tail displaying a very distinct dark gland-spot close to the root.

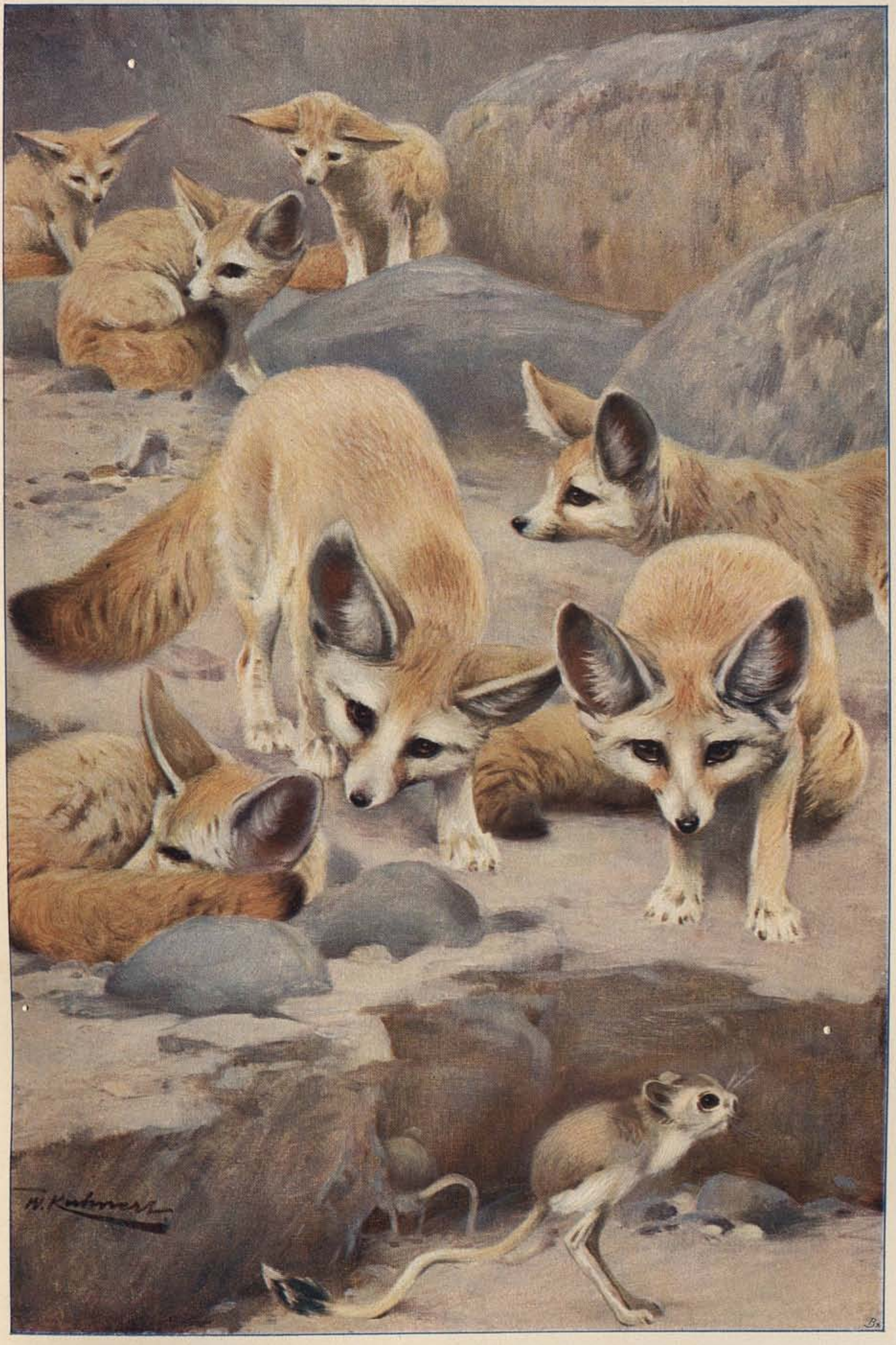
Hunting-Dog.

A very remarkable animal, the African hunting-dog (*Lycaon pictus*), differs from all other members of the *Canidæ* by having only four toes on the front, as well as on the hind feet. It is further distinguished by the peculiar blending of tawny orange, white, and black in its coat; this type of coloration, as well as the general build of the animal, recalling that of the spotted hyæna. The hunting-dog stands about 24 inches at the withers, and measures about 5 feet in length, of which some 14 inches are taken up by the tail. The range of this animal extends from the Cape through East Africa to Somaliland. In the typical southern race orange is largely prevalent in the coloration, but farther north black and white are the prevailing tints. The nearest relatives of the hunting-dog appear to be the red wild dogs, or dholes, of Asia.



HUNTING-DOG.

Hunting-dogs derive their name from the habit of associating in large packs, which run down and kill even the largest antelopes. It is reported that when the leading dogs are exhausted, those at the rear of the pack, which have husbanded their strength by cutting off corners, come to the front until the antelope is spent, and either resigns itself to its fate or stands at bay. When the latter occurs, the dogs are in nowise daunted, not even the piteous cries of a fatally wounded member of the pack being sufficient to damp their courage. Watching its opportunity, one dog will seize the antelope by the throat, and in a moment the rest of the pack will



FENNEC AND JERBOA.

get hold, and soon bring the unfortunate animal to the ground, when they commence their feast. Should the pack surprise a herd of smaller antelopes, they kill a number, and satiate themselves on the flesh, leaving the tendons and bones for the vultures. These dogs lead, on the whole, a nocturnal life, although they hunt also by day; and inflict much damage on the herds of the colonists and natives, killing and mangling many more sheep than they can devour. They are said to bite sleeping oxen on the tail, and show the greatest contempt for the dogs of the owners of the herds, upon which they make combined attacks. Domesticated dogs display their antipathy by barking for hours when they hear the cries of their wild relatives in the distance. The females give birth to their pups in burrows, which they do not hesitate to forsake on the approach of human beings.

LARGE-EARED FOXES.

Large-Eared Fox. The last member of the African representatives of the dog-tribe is the remarkable large-eared fox (*Otocyon megalotis*), a species differing from all others by the unusually large number of its cheek-teeth, and hence assigned to a genus by itself. Its range is extensive, extending from Cape Colony and German West Africa through the Transvaal, Rhodesia, and east Central Africa to Somaliland. In appearance it much resembles a fennec, its ears being unusually large and the tail very bushy. In colour it is not unlike the side-striped jackal, but the under-fur is pale yellow instead of pale purple. In length it is about 25 inches to the root of the tail, which measures another 13 inches and has its terminal third black. The great peculiarity of this fox is, however, the presence of four pairs of molar teeth in the lower jaw and either three or five in the upper; ordinary dogs having three of these teeth below and two above.

The East African large-eared fox differs from the typical Cape animal by the under-parts being of a rich buff colour instead of whitish, and also by the presence of a dark stripe along the upper surface of the tail. There are likewise slight differences in the form of certain parts of the skull and of the fourth lower molar. These differences are not, however, of more than racial value, and the animal, which was described as a distinct species, should be known as *O. megalotis virgatus*. The interest of the occurrence of *Otocyon* in East Africa is that it serves to connect the typical Cape animal with the extinct Indian *O. curvipalatus*, which is apparently the ancestral form of the genus, and thus constitutes one more link in the chain of evidence in favour of a former land-bridge between East Africa and India.

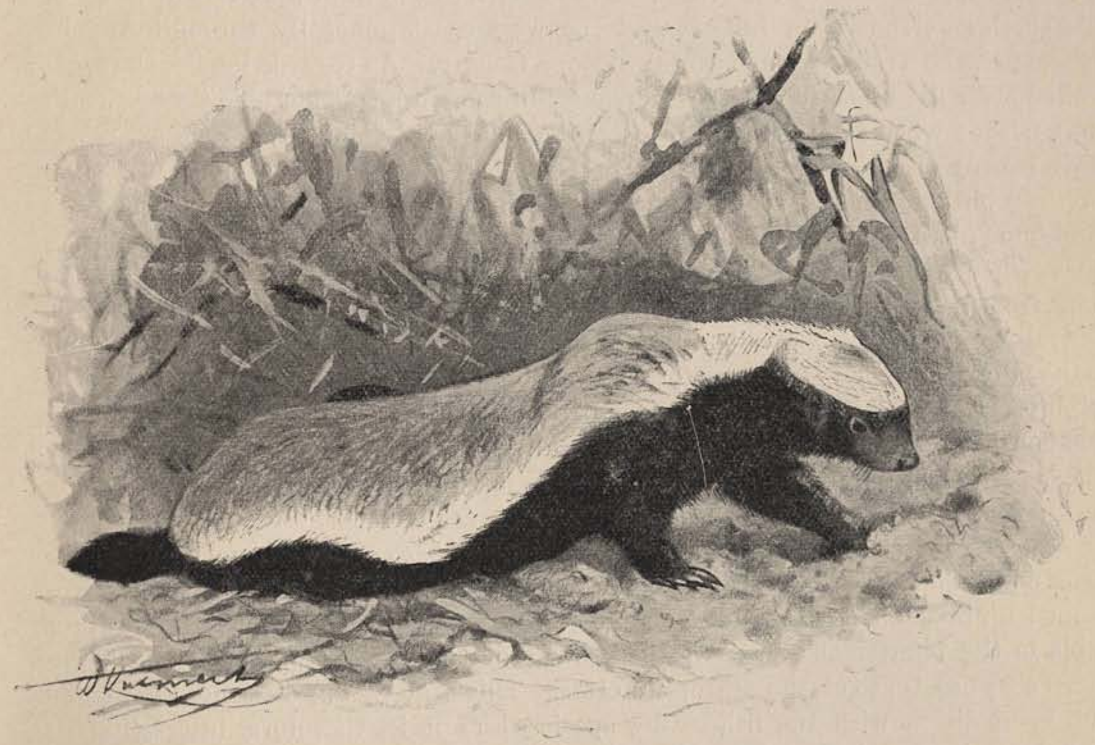
Striped Weasel and Polecat.

Although the typical genus *Mustela* is absent, the weasel tribe, or *Mustelidæ*, is represented in Ethiopian Africa by two species remarkable for their striking black and white colouring. The first of these is the striped weasel, or snake-weasel (*Pœcilogale albinucha*), which is the sole member of its genus and has a considerable range in Central and South Africa, where it extends from Angola to the east coast. The elongated, weasel-like body is marked along the back with black and white stripes, while the crown of the head and the long-haired tail are white. This species is about the size of a weasel, but the Cape polecat, or muishund ("mouse-dog"), may be compared in this respect to a polecat. This species, *Ictonyx*, or *Zorilla, striata*, which ranges from Cape Colony to Benguela, Uganda, and Mozambique, is black with white stripes on the upper-parts, the tail being also black and white: a special feature is the presence of three white spots, sometimes uniting into a band, on the head. In general habits the muishund much resembles a polecat; but it cannot climb, although it is a good swimmer. It is not a little remarkable that both these evil-smelling creatures, which no other animal will touch, have the same type of colouring and the same way of carrying their tails as skunks. The Cape polecat is represented in Somaliland and southern Egypt by *I. erythrœæ*, in Kordofan by *I. frenata*, in Senegal and Central Africa by *I. senegalensis*, and in Abyssinia, Algeria, Sennar, and Egypt by *I. lybica*, referred to in the preceding chapter as being also found in Asia Minor and the vicinity of Constantinople.

Ratels.

To the same family belongs the South African ratel or honey-badger (*Mellivora ratel*), the typical representative of a genus elsewhere represented in India. Ratels feed on honey, when it is to be obtained, and are said to follow the birds known as honey-guides in their search for this luxury. Failing honey, they are carnivorous, although they will also devour insects and fruits. When these bold animals are in a good temper, they purr like cats, when hungry they squeal, and when angry grunt and snarl, defending themselves fiercely with teeth and claws. While feeding they hold their food between their claws, which are curved inwards, resting their fore-legs on the ground, and supporting the rear of the body on the hind-feet. Grey above and black beneath, the South African ratel is distinguished from its Indian cousin by the presence of a white stripe dividing the grey of the back from the black of the under-parts. This species ranges over the greater part of Africa south of Nubia and the Gabun. In the Congo forest occurs a wholly black species (*M. cottoni*).

Another species, *M. signata*, inhabiting Sierra Leone, differs from other ratels by the completely white crown of the head, and its diet is reported to differ considerably from that attributed to other species. For, according to native testimony, this ratel, which, like the rest of its kind, is nocturnal in its habits, subsists largely upon fish, captured with its paws in shallow water. Support to this statement is afforded by the fact that while in captivity the type specimen showed a marked preference for fish, as compared with flesh. It also liked bread better than meat. When kept in the poultry-yard, it showed no inclination to molest the fowls; but when placed with a litter of puppies, it devoured them all.



HONEY-BADGER.

It has frequently been observed that in a large number of members of the weasel tribe—notably in the ratels—the ordinary type of mammalian coloration is reversed, the upper surface of the body being light and the lower dark. There the matter ended, so far as naturalists generally are concerned, till it was pointed out that as the white-bellied type of colouring is undoubtedly for the purpose of rendering the animals in which it occurs inconspicuous, it is only logical to infer that the black-bellied type is to render them as conspicuous as possible. This obvious conclusion is supported by the fact that most, or all, of the black-bellied members of the weasel tribe have the power of producing a more or less evil odour thus rendering them unsuitable as food for other animals.

Otters.

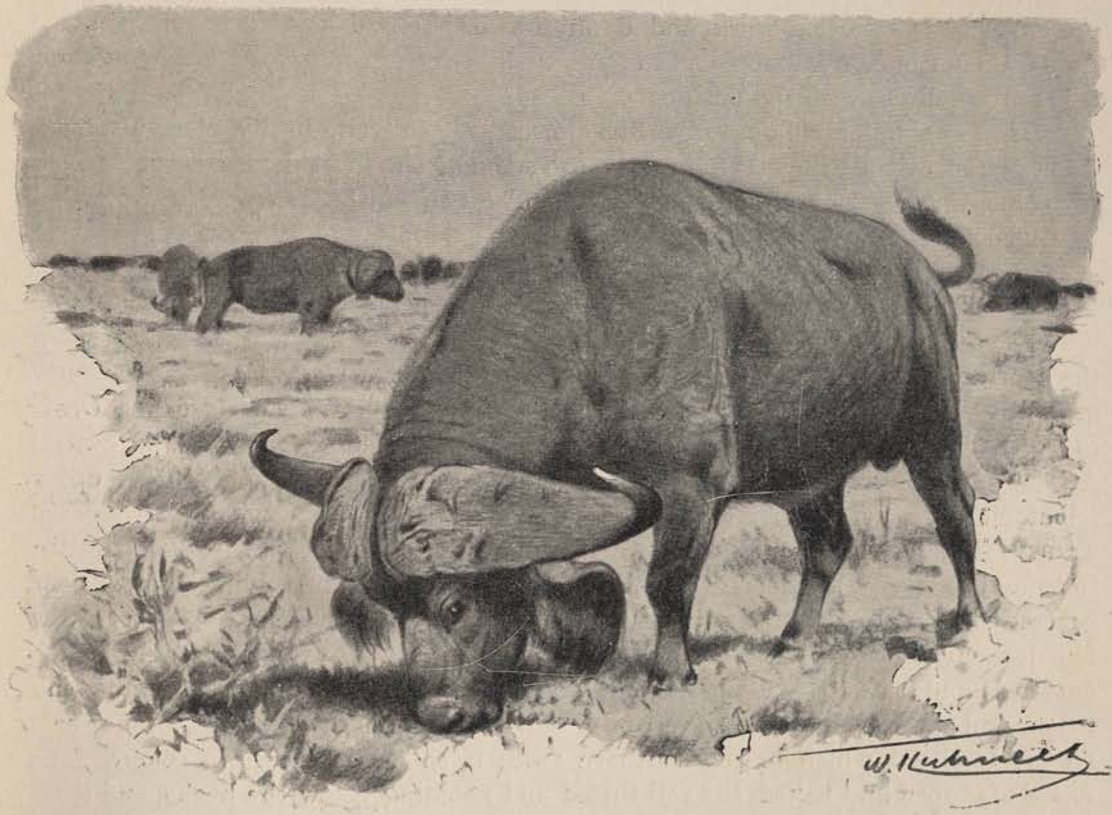
Africa possesses two otters, one being the large Cape clawless species (*Lutra* [*Aonyx*] *capensis*) which is widely distributed south of the Gold Coast and Zanzibar, ranging into Cape Colony and even to the vicinity of Cape Town itself. In the rudimentary condition of its claws this otter agrees with an Indian species. It is, however, of much larger size, measuring some 50 inches in length, inclusive of the 18-inch tail, and is indeed next in point of size to the giant otter of tropical South America. The spot-necked otter (*L. maculicollis*) is, on the other hand, a much smaller species, with fully developed claws, taking its name from the presence of a number of yellowish red spots on the throat and chest. It is also characterised by the great relative length of the hind limbs. The range of this species extends from Liberia and the west coast generally through Angola, Nyasaland, the Transvaal, and Natal to Cape Colony. As regards habits, the spot-necked otter lives mostly in the water, and can remain a considerable time beneath the surface: when coming up to breathe it exposes only the tip of its muzzle. It feeds mainly on fishes, although natives report that it robs the nests of sedge-dwelling birds of their eggs and young. The clawless Cape otter is, on the other hand, much less aquatic in its habits, being more often found among reeds or thick grass (when it may be shot over dogs) than in the water. It cannot remain more than from one to two minutes under water; and when it rises to the surface, generally exposes its whole body, the head appearing first, then the back, and finally the tail. In fact, it performs a rolling movement not unlike that of a dolphin. Examination of the stomachs of a number of specimens proves that its food consists of crabs and water-snails. In disposition it is much fiercer than the other species—so much so, in fact, that few dogs will face one when wounded. At the approach of danger it takes refuge among grass or reeds.

The East African race of the clawless species (*L. capensis hindei*), which also feeds mainly on crabs, appears to be unable to capture fish, except when they are penned up in small pools during the dry season. Correlated with the crab-eating habit is the blunter character of the crowns of the cheek-teeth, which lack the sharp cusps of those of the European otter. This crab-eating otter does not enter into competition with the fish-eating species, and it is, therefore, interesting to find that a representative of the latter inhabits the same rivers.

The small number of African representatives of the *Mustelidæ* forms a marked contrast to the great variety of the Ethiopian *Viverridæ*; and in this respect there is a remarkable difference between Africa and Asia.

Buffaloes.

Taking leave of the Carnivora, the attention of the reader may be directed to the great family of hollow-horned ruminants, or *Bovidæ*, of which Africa contains an enormous number of representatives, belonging for the most part to that indefinable group commonly known as antelopes. The ox tribe is, however, represented by various forms of buffaloes, all of which are best regarded as local races of a single variable species. In addition to certain peculiarities in connection with the skull and horns, African buffaloes are distinguished from their Asiatic relatives by the hair of the back (which in old animals often becomes extremely scant) being directed uniformly backwards, in place of inclining in the reverse direction from the loins to the nape, although it is stated that in a young bull from Uganda, received in the London Zoological Gardens during the summer of 1912, the hair of the hind part of the back was reversed in the fashion of the Asiatic species. The typical Cape buffalo (*Bos caffer*) is a huge black beast, characterised by the enormous helmet-like mass formed by the bases of the great spreading black horns of the old bulls, which are nearly in contact in the middle line of the forehead. Buffaloes agreeing more or less closely with this type extend some distance north of the Orange River, but in Uganda and the Lake Albert district we find the horns becoming flatter and thinner, as in the races respectively known as *B. c. radcliffei* and *B. c. mathewsi*. Still farther north the Abyssinian buffalo (*B. c. æquinoctialis*) is tawny or blackish brown in colour, and frequently greyish on the hind limbs. The horns of adult bulls are less massive and more flattened than those of the Cape buffalo, and are separated on the forehead by a broad strip of hairy skin, as in some of the above-mentioned East African buffaloes. From Abyssinia and the south of Somaliland buffaloes identical with or closely allied to *B. c. æquinoctialis* extend some distance up the valley of the White Nile.



CAPE BUFFALO.

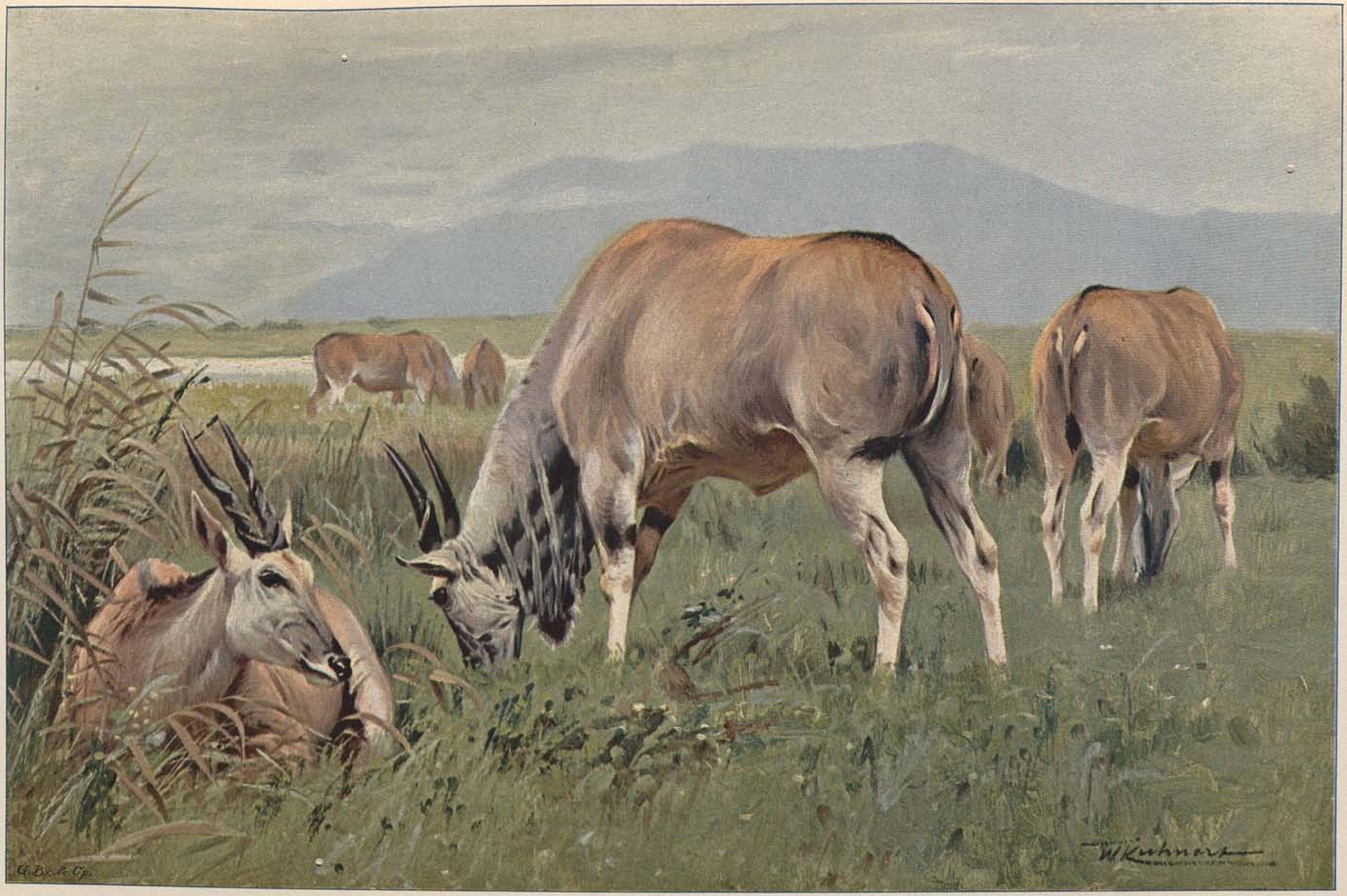
On the north side of the Congo Valley is to be found a small red or yellow buffalo (*B. c. nanus*), whose height at the shoulder is only about 42 inches. The ears of this dwarf Congo buffalo are heavily fringed with long hair, and the horns are of an altogether peculiar shape, being much flattened at their bases (where they are widely separated) and more or less markedly incurved at the tips, which are smooth and conical. This buffalo apparently ranges into the Gabun and Gambia, but in the interior of Senegambia seems to be replaced by a larger brown race, *B. c. planiceros*, in which the horns of the bulls are more extended outwards and recurved. This race not improbably intergrades with the Abyssinian buffalo. In the Lake Chad district occurs yet another race, *B. c. brachyceros*, and there are other types in Nigeria, in one of which the adult bulls are black, while young bulls and cows at all ages are red or tawny. To particularise the numerous local races into which the African buffalo has been divided is, however, quite beyond the scope of the present work, and it must suffice to add that to the natives the dwarf Congo buffalo is known as the niari, while by Europeans on the west coast it is universally termed the bush-cow.

Of the habits of buffaloes it will be unnecessary to write in this place, although it may be mentioned that these animals are some of the most dangerous of African big-game, and that of late years their numbers in East Africa were decimated by rinderpest.

Eland.

The plains of southern and eastern Africa were in former days a very paradise for antelopes, which were far more numerous, both in individuals and species, than in the whole of the rest of the world. Largest of all are the elands, of which the typical species, now generally known by naturalists as *Taurotragus oryx*, but formerly called *Oreas canna*, originally ranged over the greater part of southern, eastern, and central Africa, extending in one direction to Angola, and in the other to the upper tributaries of the Nile. At the present day it is rare except in the eastern Transvaal, Zululand, Rhodesia, Nyasaland, and East Africa generally. In addition to being the largest and heaviest of all antelopes, eland are distinguished from their nearest relatives, with the exception of the bongo, by the presence of horns in the females. In both sexes the horns form a close spiral, with few turns, and incline outwards and backwards almost in the plane of the face; those of the cows being longer and more slender than those of the bulls. Old bulls have a thick mass of hair on the forehead, which in the southern races is chocolate-brown in colour. The muzzle is broad and naked, the tail tufted and reaching below the hocks, and there is a well-developed dewlap. In colour the ordinary eland is pale reddish fawn or bluish grey, the bluish tinge becoming more pronounced with advancing age, when the coat tends to become thin and allows the colour of the skin to show through. The typical southern race has the body-colour nearly uniform, but the eland of the Zambesi district have a dark line down the back, and the sides of the body marked with vertical white stripes, while there is also a dark garter on the inside and back of the fore-legs just above the knees. This striped race is known as *T. o. livingstonei*. As we continue north these striped eland gradually develop two oblique white lines on the face below the eyes, and the bulls have apparently a shorter and lighter-coloured "bush" on the forehead. The Laikipia representative of these chevron-faced eland has received the name of *T. o. pattersonianus*.

A fine eland of the ordinary species stands from 5 feet to 5 feet 7 inches at the withers, while the length of the head and body is about 10 feet; the tail being about



ELAND.

a yard long. Average horns of bulls measure about 24 inches, but a specimen of 33 inches is known, and in cows a length of 34 inches has been recorded.

A far finer and handsomer animal is Lord Derby's eland (*T. derbianus*), which ranges from the open districts in the heart of Senegambia to the neighbourhood of Lado, on the Equator, and the Bahr-el-Ghazal province of the Egyptian Sudan, where it appears to be represented by a local race known as *T. d. gigas*. This species, in addition to its superior size, differs from the ordinary eland by its larger and broader ears, bigger horns, blackish neck, and chestnut ground-colour of the coat, upon which the white stripes stand out conspicuously. Fine horns of bulls measure at least 40 inches in length.

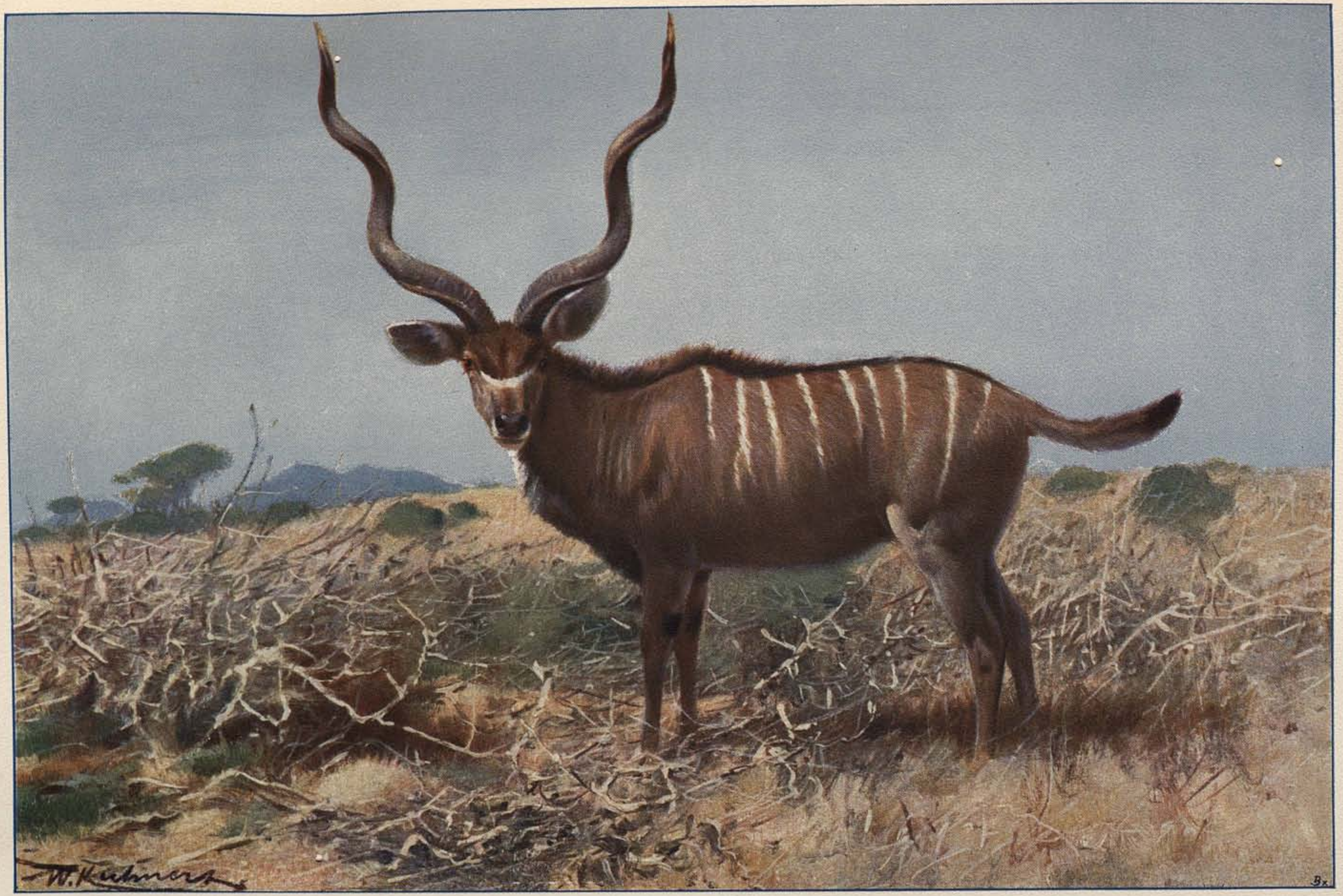
The ordinary eland frequents alike more or less desert plains, hilly country, and particularly wooded districts with occasional open plains. Here these splendid antelopes associate in small herds, which retreat when disturbed in single file, with the younger members of the party in the van and the old bulls bringing up the rear. Judging from the large size of its ears, Lord Derby's eland must be much more of a forest animal than the typical species.

Bongo.

Of the brilliantly coloured antelope known to the natives of the west coast as the bongo, and to naturalists as *Boöcercus euryceros*, long supposed to be confined to the tropical forests of the west coast, complete skins would appear to have been first sent to England by Paul du Chaillu the explorer, although the species had been known to science at a considerably earlier date by its horns. It was not till much later that the species was found to exist in the Mau Forest and other parts of East Africa, this indicating that it extends right across the great equatorial forest tract. By naturalists the East African bongo (*B. e. isaaci*) is considered to be distinguishable from the typical western representative of the species; but the differences between the two are so slight that they may be disregarded by the ordinary observer. The bongo is an animal considerably larger than a park red deer, and, in fact, approximating in stature to the eland. Bongos also resemble elands in that the cows as well as the bulls carry horns, the horns in the bulls being very massive, with a wider and less screw-like spiral twist than in elands, and always characterised by their yellow tips which contrast strongly with the olive brown of the general surface. These yellow tips are due to the animal rubbing its horns against tree-trunks and branches, and apparently, also, to their being used for digging in the ground, whereby the outer coat becomes worn off. What renders the bongo such a strikingly beautiful animal is, however, the brilliancy of its colouring, the ground-colour of the short and somewhat silky coat being warm orange-red, upon which are a number of narrow vertical white stripes all over the neck and body, together with a chevron and other white markings on the head. Another striking feature of the bongo is the relatively large size of the spreading ears, which at once proclaims this antelope to be a denizen of the forest, large ears being essential to forest-dwelling animals in order to enable them to catch every vibration of sounds which become broken by the stems and branches of the trees. Another characteristic of many forest animals is the prevalence of vertical white stripes on a reddish or tawny ground; such a type of colouring, although glaring and conspicuous enough in an animal exhibited in a museum or alive in a menagerie, being apparently almost invisible among the vertical lines of light and shade in a tropical forest. It is further noteworthy that among tropical animals, where the surrounding conditions are similar throughout the year, such a type of colouring is retained permanently. On the other hand, in animals of the temperate zone, like the fallow deer, in which the colouring is intended to harmonise with the checkered shade cast by deciduous trees on the ground beneath their branches, the white-spotted summer livery is exchanged in winter for a uniformly russet or olive coat. In the general character of its horns and colouring the bongo approximates to the under-mentioned bushbucks, in which, however, the females are frequently much more brilliantly coloured than their partners, but it differs in the presence of horns in both sexes, as well by the distinct tuft at the tip of the tail. Bongos, which live at a considerable elevation in the mountain forests of both West and East Africa, appear to be almost exclusively nocturnal animals, and very difficult to approach, even when in repose during daylight, on account of their keenness of scent. They feed mainly on leaves and bark, and will, it is affirmed, rear themselves on their hind-legs against the stems of trees in order to obtain these at a far greater height than would be otherwise possible. Small trees are also uprooted with the aid of the horns, and the roots eaten. The red, salt-impregnated earth so common in many parts of Africa is also a favourite food of the bongo, as are likewise the charred ashes of the burnt trunks of forest trees. Bongos usually associate in small family parties, which perambulate the forests with their horns well bent back so as to protect their bodies as much as possible from injury, the whole body thus assuming somewhat of a boat-shape, with the muzzle as prow. Obstacles are pushed aside by sheer bodily weight, while heavy boughs projecting across the path and too stout to be thrust away in this manner are crept under; the smallness of the apertures through which a bongo manages to creep being almost beyond belief.

Kudu.

With the kudu (*Strepsiceros capensis*), which ranges from Cape Colony through Bechuanaland into Angola, and also through the Transvaal, Rhodesia, Nyasaland, and East Africa into Somaliland and Abyssinia, we come to one of the handsomest of all the larger antelopes of South and East Africa, where it was formerly met with in considerable numbers. Kudu are characterised by the length and open spiral of their horns, which are normally borne only by the males, and are twisted in cork-screw fashion, with a strong keel in front; the two horns forming a sharp angle with one another, and inclining more or less outwards. Kudu-horns may measure 5 feet 3 inches along the curve, the animal itself standing as much as 4 feet 10 inches or more at the shoulder, and measuring about 8 feet to the tail, which adds another 20 inches to the length. In colour the females and young males are reddish or greyish brown, marked with eight or nine white stripes, but old males are bluish grey, in consequence of the sparse covering of hair which permits the colour of the skin to show through. Kudu frequent thickly-wooded hilly country, and are also found in the thickets on the banks of rivers, as well as in the thorn-jungle of the lower Molapo at the edge of the Kalahari Desert. During the dry season of the year they eat, in addition to grass, the young shoots of trees and shrubs; and are generally found grazing in pairs or small companies. These antelopes are not very swift, and even when



KUDU.

disturbed, do not exhibit any great rapidity of movement. Nevertheless, they are not easy to hunt on horseback, as tsetse-flies are common in the districts they frequent, and when pursued these antelopes invariably make for the most uneven ground. The Somali race of the kudu (*S. c. chora*) has fewer stripes than the southern animal. In Somaliland the kudu, although in most other parts of Africa a water-loving antelope, has taken to browse on aloes, and is thus enabled to exist for long periods without drinking. The beisa oryx, on the other hand, when in waterless districts is in the habit of feeding largely on a small gourd locally known as *unun*, which grows abundantly in the haunts of these antelopes, and is full of juice. The stomach of every oryx killed during the dry season in the district will be found crammed with *unun* seeds.

The lesser kudu (*S. imberbis*), of East Africa and Somaliland, differs not only by its inferior size but by the absence of a fringe of long hair on the throat and the closer spiral of the horns. In Somaliland, where the larger species is met with in the mountains, the smaller kind frequents the thickets at the foot.

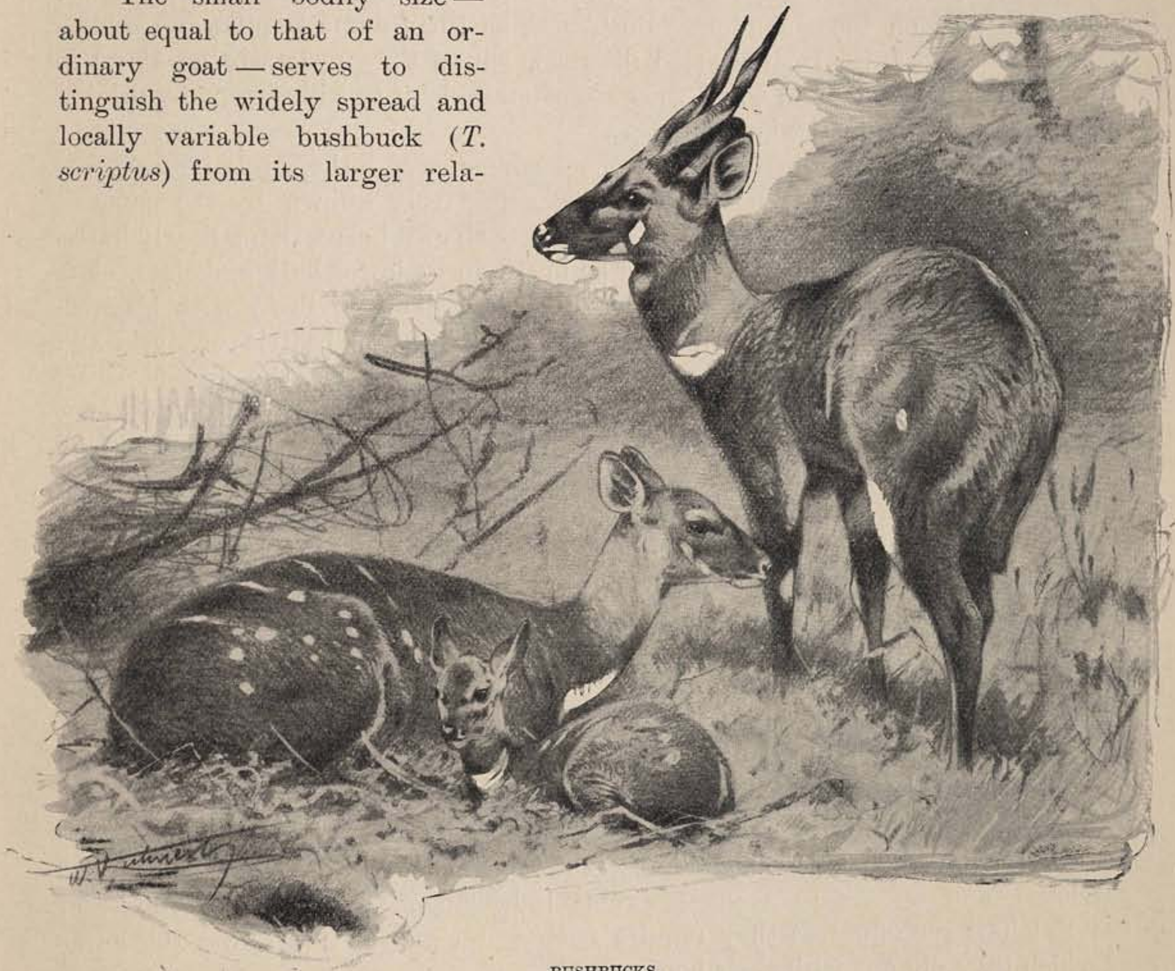
Bushbuck Group. An exceedingly handsome group of antelopes is formed by the bushbucks and their larger relatives the nyala, mountain nyala, and situtunga, constituting the genus *Tragelaphus*. The larger species are often known as harnessed antelopes. As a rule, the horns have fewer spiral turns—often only one or two—than those of the kudus, and their keels are less distinctly marked. The colouring and markings in the two sexes are not unfrequently different, the males in some cases being dull grey brown, while the females are extremely brilliant, showing, on a darker ground, stripes and spots so arranged as to suggest the idea of the animals being in harness. One of the three larger members of the group is the nyala, or inyala (*T. angasi*), ranging from Zululand northwards of the Zambesi as far as the Shiré. Standing about 38 inches at the shoulder, the bucks carry horns measuring from 20 to 24 inches in a straight line, and 23 to 29 inches along the spiral. The long coat of the bucks is greyish brown in ground-colour, marked with a few faint white stripes, while that of the does is mahogany-red with numerous and distinct stripes.

A larger species, discovered in 1910, is the mountain nyala (*T. buxtoni*), of the Arusi plateau of Gallaland, in the Sahatu Mountains. In this antelope, which stands about 4 feet 4 inches at the shoulder, the horns of the bucks make about one complete turn, and have the general characters of those of the nyala, although relatively heavier, and diverging much more outwardly, with a very open spiral. They are obliquely ridged at the base, and the long smooth terminal portion is worn yellow at the tip. The length along the outer curve is 37 inches, the basal girth 9¼ inches, and the tip-to-tip interval 21 inches. In the type specimen the coat is rather long and coarse, its general colour being speckled brown-fawn, passing into dull tan on the sides of the face, and becoming darker on the front surface of the muzzle, and chocolate-brown on the forehead above the white chevron, which is not very conspicuous. The under-parts are lighter, but on the front of the fore-legs and the lower part of the hind-pair the tuft becomes considerably darker. There is a short dark brown mane on the neck, continued backwards as a mingled brown and white dorsal crest. The bushy tail is white beneath. The ears, which are much of the same type as those of the nyala, are of moderate width, bluntly pointed at the tip, and tubular for a considerable distance at the base; most of the long hairs on the inner edges being white, as is also much of the inner surface of the outer margin. The white markings include a not very distinct chevron between the eyes, the usual tragelaphine patches on the sides of the muzzle and chin, a pair of spots on each side of the face below the eye, and a smaller and fainter one behind the same, a narrow but deep gorget on the throat, and a much wider but less deep band of a more lunate shape on the upper part of the chest. A curved row of nine spots—some of which are fainter than the rest—extends from a point about over the head of the thigh-bone to the back of the lower part of the shoulder. There is another white spot on each side of the buttocks. The inner surface of the thighs and of the upper portion of the fore-legs is dirty white; a white area occupies the back of each fore-leg below the knee, extending on to the outer and inner surfaces of the limb, but not reaching the pastern; and a somewhat similar patch occurs on the hind-leg, extending slightly above the hock. There is a pair of white oval spots on each fetlock some distance above the hoof.

In the head of a much older buck the horns, which are of greater length, form about one turn and a quarter, and have a more upright direction than in the type specimen; in both of which respects they are more nyala-like. Although the buck to which this head belonged was a member of the same herd as the type, the coat is considerably longer and looser, especially on the throat, where it forms an incipient fringe. The colour is also darker and greyer, being a greyish brown, comparable to that of a waterbuck. The face is darker, the whole of the lower portion being chocolate-brown like that of the forehead, and the tan restricted to the area round the eye, behind which is a small white patch. In consequence of the darker colour of the rest of the face, the white frontal chevron is much more conspicuous than in the type specimen; and the upper throat-patch or gorget is also very conspicuous, and is continued by means of scattered white hairs almost to the lower gorget. The body-skin of a similar buck differs from that of the type in its longer and darker hair and the greater development of the dorsal crest, as well as in the presence of two indistinct vertical white stripes on the hind-quarters, with faint traces of a still shorter third one. In this respect the specimen makes a further approximation to the nyala. Taking all its characteristics into consideration, the mountain nyala appears to come nearest to the species from which it takes its name, although in the general form of the head and the character of the tail it is distinctly kudu-like. It tends to connect the bushbuck group so closely with the kudus as to render the generic separation of the latter from *Tragelaphus* inadvisable.

From both the preceding species the situtunga, or nakong (*T. spekei*), differs by the great elongation of the hoofs, in adaptation to a half-aquatic life among the papyrus-swamps on the borders of the great lakes and rivers of the equatorial districts. In the typical situtunga of the Victoria Nyanza and adjacent districts of east central Africa the long, coarse coat of the full-grown bucks is uniform greyish brown, but that of the does is rufous with faint indications of striping. In the situtunga of the Zambesi (*T. s. selousi*) both sexes are of the same greyish brown colour; but in the West African (*T. s. gratus*) the ground-colour is grey in the bucks and rufous in the does, with numerous white or whitish spots in both. Situtungas stand about 42 inches at the shoulder; and the males carry horns of from 23 to 28 inches in a straight line, and from 30 to 35 along the spiral. These antelopes pass almost the whole of their lives in the water of papyrus-swamps and reed-brakes, so that it is difficult to ascertain their habits in detail. They swim and dive with facility; and when hunted often show only their muzzles above the surface.

The small bodily size — about equal to that of an ordinary goat — serves to distinguish the widely spread and locally variable bushbuck (*T. scriptus*) from its larger relatives. The bushbuck ranges practically all over Ethiopian Africa in localities suited to its habits, from Abyssinia to the Cape, and stands from 30 to 36 inches at the shoulder, with a maximum horn-length of about 20 inches. The bucks have a crest of long hairs down the back, which in some cases is white and capable of erection, but in other races is black and non-erectile, as it is nearly always in the does. Some races, again, have a short-haired collar round the neck, which is capable of inflation, and is probably of a glandular nature. As to colour, this varies from bright red with numerous white stripes and spots to almost uniform brown. To particularise the local races—at least sixteen in number—



BUSHBUCKS.

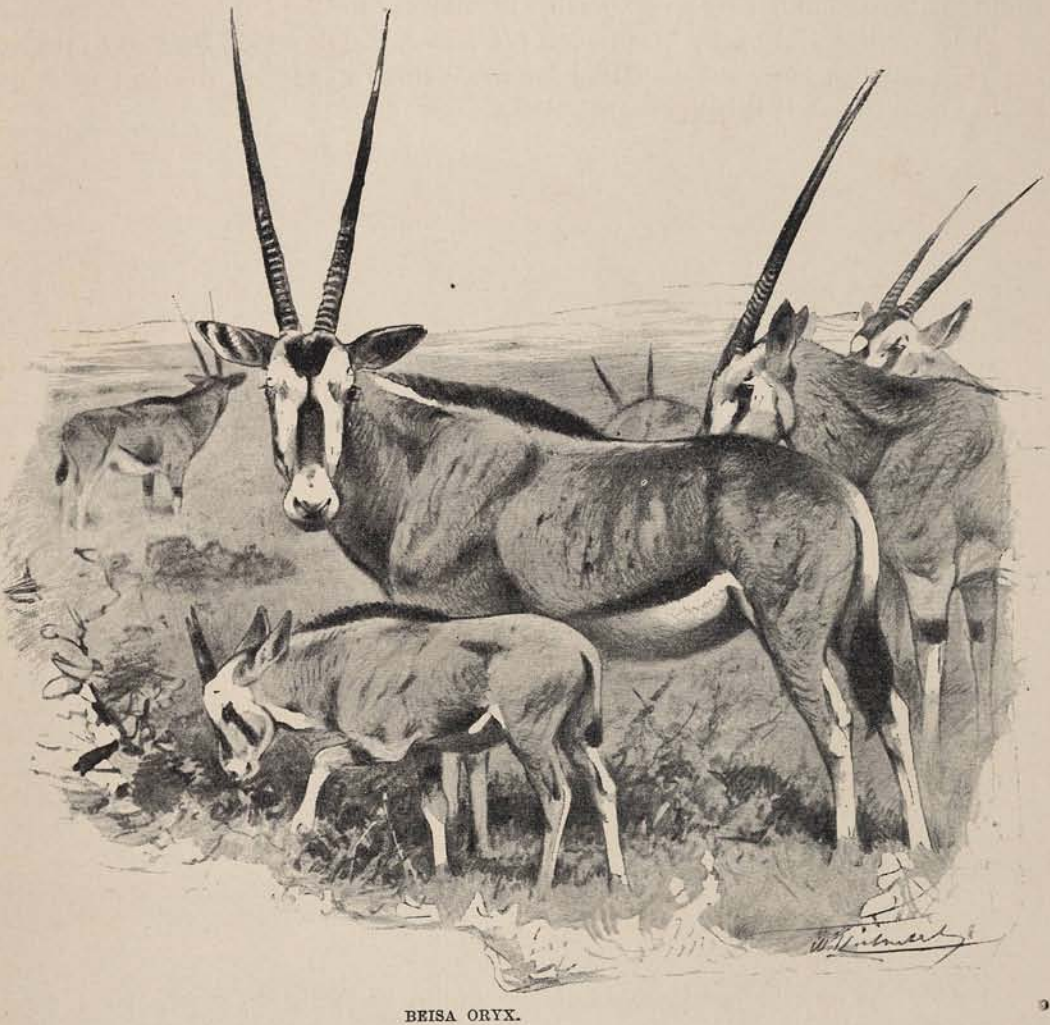
would be out of place in the present work, and only a few will be mentioned. The typical representative of the species is the West African bushbuck, in which both males and females are bright rufous, with full striping and spotting. In contrast to this is the small Abyssinian race (*T. s. decula*) in which the general colour is yellowish, with but faint traces of stripes and spots, the crest down the back being black. The Cape bushbuck (*T. s. sylvaticus*), again, is typically dark brown in the male, with only a few indistinct white spots on the shoulders and haunches; the females being reddish brown, with spots on the hind-quarters, and sometimes also on the shoulders. Bushbuck, as their name implies, are seldom found at any distance from wooded districts, where they generally go about in pairs. Being nocturnal and wary, they are often difficult to kill, except by driving out of covert, as is practised at the Cape.

Oryx. Very different from the bushbucks and their relatives are the medium-sized desert antelopes collectively known by the name of oryx. Both sexes carry long, straight, or scimitar-shaped horns, rising nearly in the plane of the face; the long tail tends to be bushy in its lower half, and the neck is maned. The general body-colour is usually some shade of fawn with blackish markings; but in the North African white oryx and the beatrix of Syria and Arabia, which are referred to in earlier chapters of this book, the ground-colour is whitish, with chestnut patches, as indeed is mentioned in the preceding chapter.

In South Africa the group is represented by the well-known gemsbuck (*Oryx gazella*), which is still fairly numerous in the Kalahari, especially in Damaraland, and ranges northward so far as the desert extends into Angola. The long, straight horns are ringed for about half their length; the whitish face has three blackish streaks, two of which pass through the eyes, while all three stop short above the muzzle, where they are connected by a transverse band, thus suggesting the appearance of a headstall. Down the middle line of the throat runs another dark stripe, developed into a tuft on the chest, and below this dividing and continuing on each flank to separate the fawn of the back from the white of the underparts. A gemsbuck bull stands from 45 to 48 inches at the shoulder, and the head and body measure over 10 feet in length, to which must be added another 27 inches for the tail. Horns average about a yard in length, but in some instances about equal the shoulder-height. Gemsbuck are essentially desert antelopes, and appear to a great extent independent of water, obtaining in the Kalahari such fluid as they require from water-melons and bulbs, the latter of which they dig out with their hoofs.

The beisa or true oryx (*O. beisa*), which is typically a native of Somaliland, Abyssinia, and the coast of the Red Sea, differs from the gemsbuck by the dark markings on the face being disconnected at their lower ends, the absence of a throat-tuft and of dark markings on the hind-quarters, and the shorter horns. Forty inches, and an inch less in the female, is about the maximum length for beisa horns. In East Africa the species is represented by the fringe-eared beisa (*O. b. callotis*), so called from the presence of tufts of long hair on the tips of the ears.

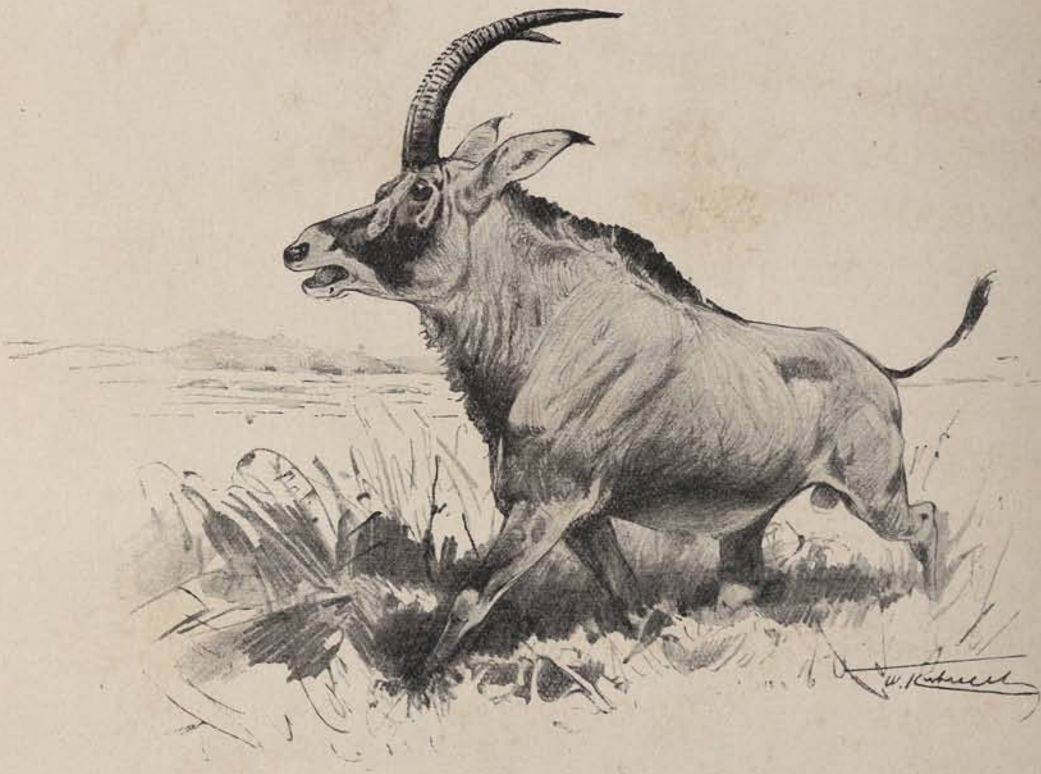
The oryx inhabiting the Laikipia Plateau, of British East Africa, which in many respects connects the Abyssinian and Somali beisa with the fringe-eared beisa of the Kilimanjaro district, has been named *O. b. annectans.* It is described as being generally like the typical *beisa*, but with the dark flank-stripe narrower and the head-markings approaching those of *callotis.* Then the black stripe passing through the eye extends downwards and forwards nearly to the angle of the mouth, and the face-patch is broader at its lower end, so that the two dark areas are closely approximated, as in *callotis.* In some cases the eye-stripe passes down to unite with the black throat-stripe. The cheek-teeth are intermediate between the small ones of *beisa* and the large ones of *callotis.*



BEISA ORYX.

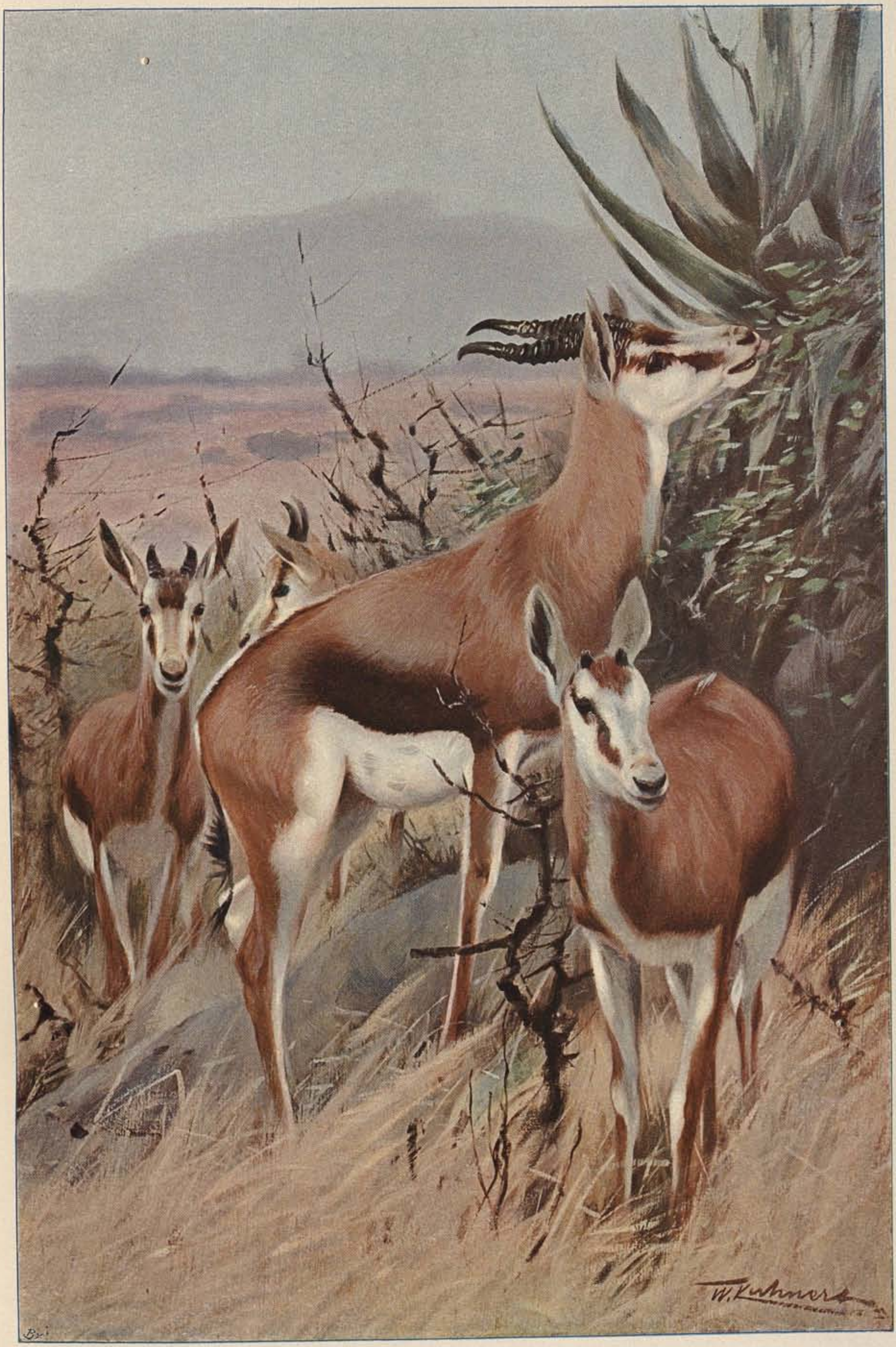
Roan and Sable Antelopes. Near akin to the oryx group are the large and handsome species respectively known as the sable antelope (*Hippotragus niger*) and the roan antelope (*H. equinus*); the former being by far the more striking animal of the two. The roan antelope, which is the larger, and is represented by several more or less distinct local races, occurs, in suitable localities, almost everywhere south of the Sahara, as well as in north-west Africa. Among its characteristic features are the large ears, large white eye-tufts, cut off from the white of the muzzle by a transverse band connecting the dark middle band of the face with the two eye-stripes, and the medium-sized, sabre-shaped horns, which attain a length of about a yard. The neck carries an upright mane, the ears are lined with long white hairs, and there is a white streak between these and the eye-stripe of each side. The colour varies locally, but is typically reddish roan; in the Sudani race (*H. e. bakeri*) the colour is redder and the ear-tufts are longer; the East African *H. e. langheldi* is also reddish, but with the tufts on the ears shorter; while the Senegambian *H. e. gambianus* is reddest of all.

The smaller, slaty grey blaauwbok (*H. leucophæus*), which formerly inhabited Cape Colony, has been exterminated for more than a century, the last individual having been killed, it is believed, about the year 1800.



ROAN ANTELOPE

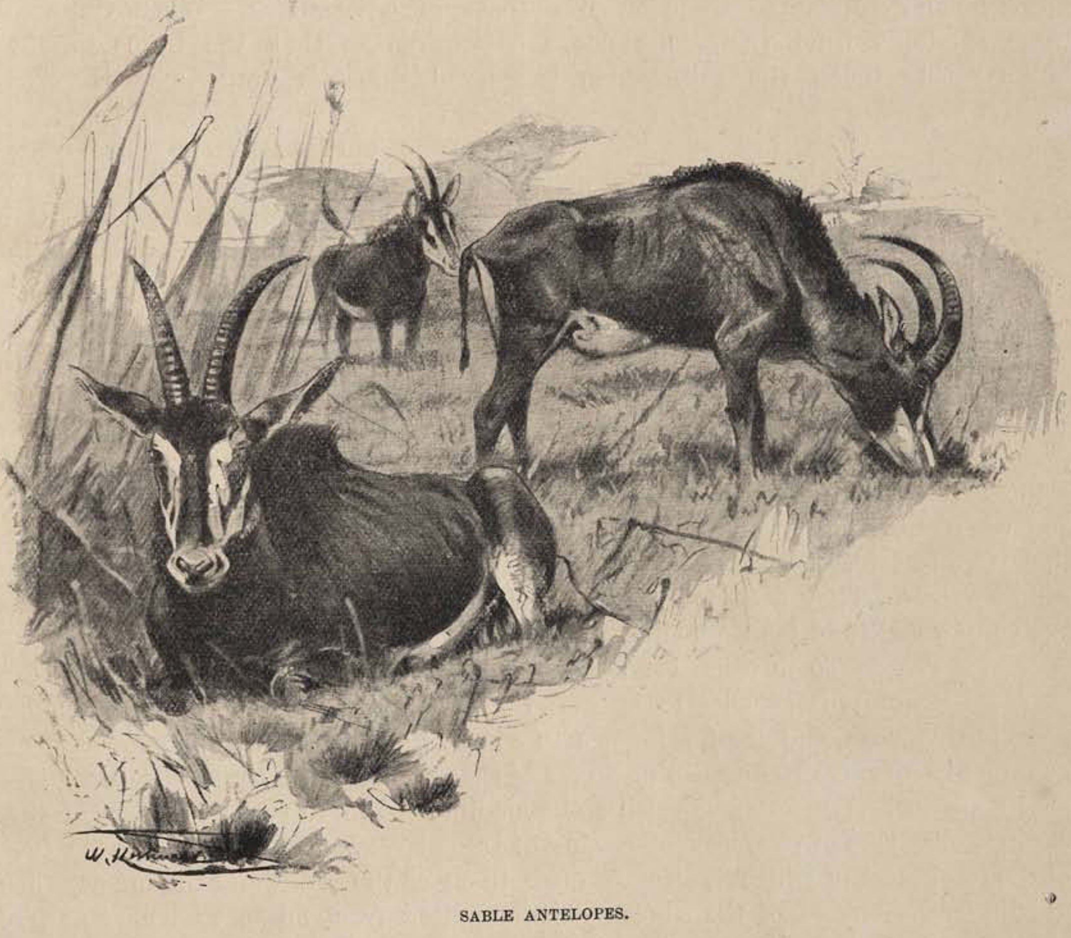
By far the handsomest member of the group is the sable antelope (*H. niger*), which inhabits Rhodesia, the Transvaal, Mashonaland, Nyasaland, and East Africa. In the Harrisbuck, as this species is often called, the black stripe on the middle line of the face extends from the horns to the muzzle, but the eye-stripe dies out before reaching the latter, and there is no white stripe behind the eye. Between the central dark stripe and the eye-stripe is a white band, and the lower part of the face in advance of the line of the eye and below the eye-stripe is also white. The white eye-tufts and the ears are smaller than in the roan antelope. Elsewhere the coat of the old bulls is glossy black on the upper-parts and white beneath; the cows are browner, and the calves rufous. Horns exceeding 50 inches are known; but from 45 to 47 inches is a good size for fine specimens. In height the sable



SPRINGBOK.

antelope stands about 4½ feet at the shoulder, and in length it measures about 9½ feet inclusive of the tail, which averages 24 inches.

Springbuck. Passing on to the gazelles and their allies, the first species for mention is the South African springbuck (*Antidorcas euchore*), whose range extends to the southern boundary of the karu through German South-west Africa, Bechuanaland, the Orange River Colony, and the Transvaal; northwards it reaches Benguela and Angola, but does not include Mashonaland or Matabililand. The springbuck is easily distinguished from the true gazelles by a strip of long erectile white hairs known as the "fan," running along the middle of the hinder half of the back. Both sexes carry horns, which are black and lyre-shaped, with about twenty rings; those of the bucks reaching from 15 to 19 inches, those of the female from 10 to 13 inches. The shoulder-height of the bucks is about 30 inches, the length 70 inches, inclusive of the 15-inch tail. The springbuck is one of the brightest-coloured members of the group, being generally dark cinnamon-yellow above, and white below, with no dark stripe along the flank where the colours meet. The face is white with a dark stripe from the horns to the angles of the mouth, and the ears are whitish on the inner surface. Springbuck



SABLE ANTELOPES.

are so called from their well-known habit of leaping into the air with their backs arched and the fan displayed. At one time they existed in countless numbers on the dry open country, across which they migrated in tens of thousands to the limit of their western range at the breeding-season in order that the fawns might find suitable food in the fresh pastures. For an account of these "trekbokken," as these migrations are called by the Boers, the reader may refer to Gordon Cumming's well-known volume.

Dibatag.

Central Somaliland is the home of the dibatag (*Ammodorcas clarkei*), a species closely related to the true gazelles, but differing by the long neck, long thin tail, and the shape of the black horns, which curve upwards and forwards, somewhat like those of a reedbuck. When running, these antelopes bend their long necks backwards so that the horns of the bucks nearly touch the tail, which is curved upwards and forwards. The females are hornless.

Gerenuk.

Another remarkable species from north-eastern Africa is the gerenuk (*Lithocranius walleri*), which ranges from Somaliland to German East Africa. This is a gazelle-like antelope, in which the length of the neck has caused it to be likened to a miniature giraffe. The horns resemble in shape a long reversed S, curving forwards, upwards, backwards, and then forwards again so as to form a sort of hook. The females resemble those of the dibatag in lacking horns. Both sexes have a large glandular inflated area round the eye. The general colour of the upper-parts is rufous cinnamon, with a broad band of darker rufous along the middle line of the back. Gerenuk are generally met with on rocky ground sparsely covered with thorn-bushes, and never on treeless plains. The leaves of trees and bushes, rather than grass, form their chief food, and when browsing on trees they may be seen standing on their hind-legs with their fore-feet reared against the stem, and the giraffe-like neck stretched to its fullest extent. They were known to the ancient Egyptians, as is attested by a sketch of a male and female incised on a slab of slate.

Gazelles.

To mention even by name the whole of the numerous species of true gazelles to be found in Ethiopian Africa would be out of place in this work, and brief reference to some of the more striking species must accordingly suffice. The largest members of the genus are the three so-called giant gazelles, which have been suggested to be modified northern representatives of the springbuck. One of the most interesting of these is the dama (*Gazella dama*), two of the local races of which are known respectively as the addra and the mhor. This gazelle is the largest of the whole group, standing from 36 to 37 inches at the shoulder. In colour it presents a remarkable analogy to the white oryx, the greater portion of the body being white with patches of chestnut, which may include most of the neck. This pale colouring is an adaptation to a desert existence; the dama ranging over the desert tracts of central North Africa from Senegambia to Kordofan and Sennar, so that it forms a kind of connecting link between the faunas of North and Ethiopian Africa. The black lyrate horns are of medium length. Of a more normal type of colouring is the handsome Sömmerring's gazelle (*G. sœmmerringi*), ranging from the Abyssinian coast of the Red Sea, through Berbera, the east side of Sennar, Danakil, and Bora-Gallaland to Somaliland, where it is locally known as the aoul. The black blaze down the face, and the inward bend of the tips of the heavily ringed horns sufficiently distinguish this fine species. The third and last member of the giant group is the East African Grant's gazelle (*G. granti*), which may be recognised by the great length of the sublyrate horns of the bucks and the presence of a black nose-spot. Several local races of this species are recognised, among them being Peters's gazelle (*G. g. petersi*) of the Tana Valley. In common with those of gazelles generally, the females of the three giant species carry small horns.

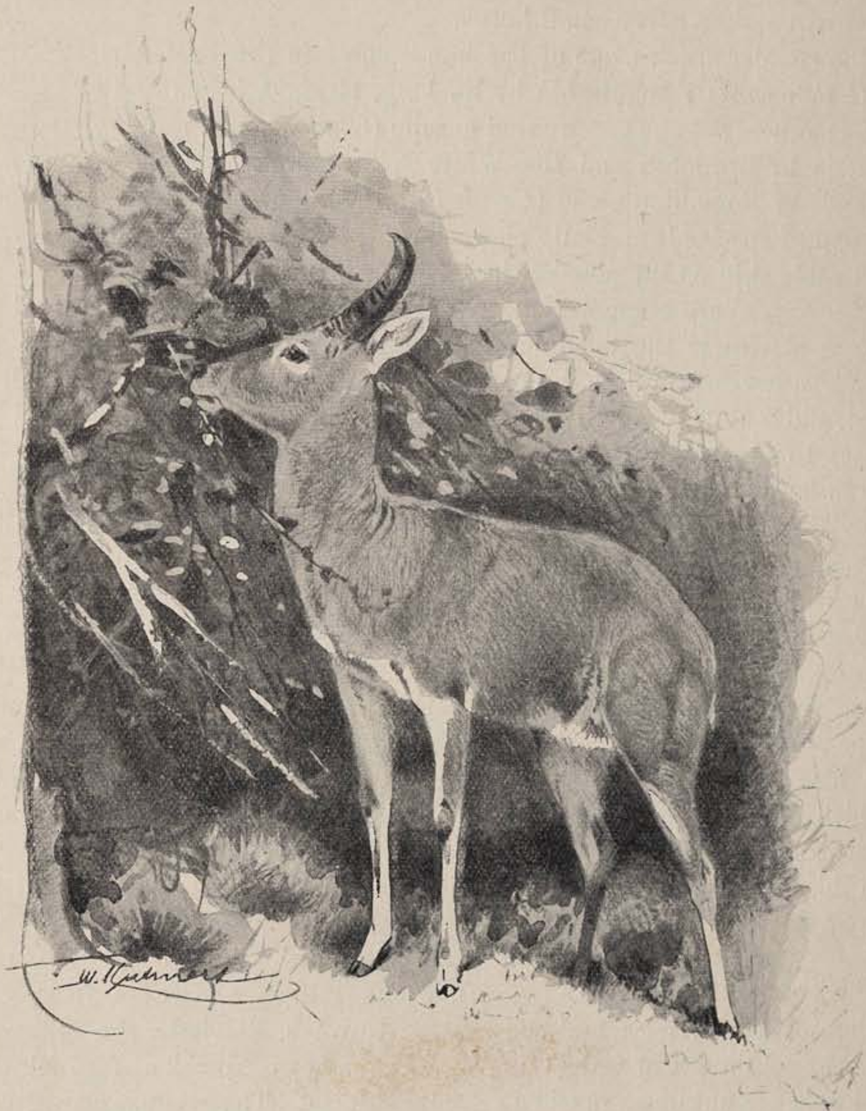
Of the smaller species, one of the handsomest is the East African Thomson's gazelle (*G. thomsoni*), recognisable by its long, straight horns and wide chocolate flank-band; others are the red-fronted gazelle (*G. rufifrons*), ranging from Senegal and Gambia to Kordofan and the White Nile, Pelzeln's gazelle (*G. pelzelni*) of the lowlands of Somaliland, and *G. spekei* of the highlands of the same country. The last-named species is specially characterised by the presence of an elevation of loose, inflatable skin on the nose of the bucks.

Pala.

Very characteristic of the open plains of southern and eastern Africa is the medium-sized foxy red antelope known as the pala or impala (*Æpyceros melampus*), the range of which extends from Bechuanaland, the Transvaal, and Zululand through Rhodesia, Nyasaland, and German and British East Africa to the White Nile. Pala are never found far away from water, and associate in large or small herds, generally on the banks of rivers; these herds consisting for the most part of females, although the young males occasionally form small herds by themselves. When alarmed, pala whistle, but in the pairing-season also utter a hoarse, guttural bark. Their leaping powers are extraordinary; one having been known to clear 70 feet in three bounds. The colour is bright rufous fawn above and white below. The slender, lyrate horns, which curve outwards, then inwards, and after this are directed straight upwards, are ringed for about two-thirds their length, and measure about 2 feet in a straight line. A black line on the rump, as well as the black patches on the hind-feet from which it takes its name, and the absence of lateral hoofs, are characteristic features of the pala. The Angola pala (*Æ. petersi*), distinguished by a blackish blaze on the face, replaces the typical species in Angola and German South-west Africa.

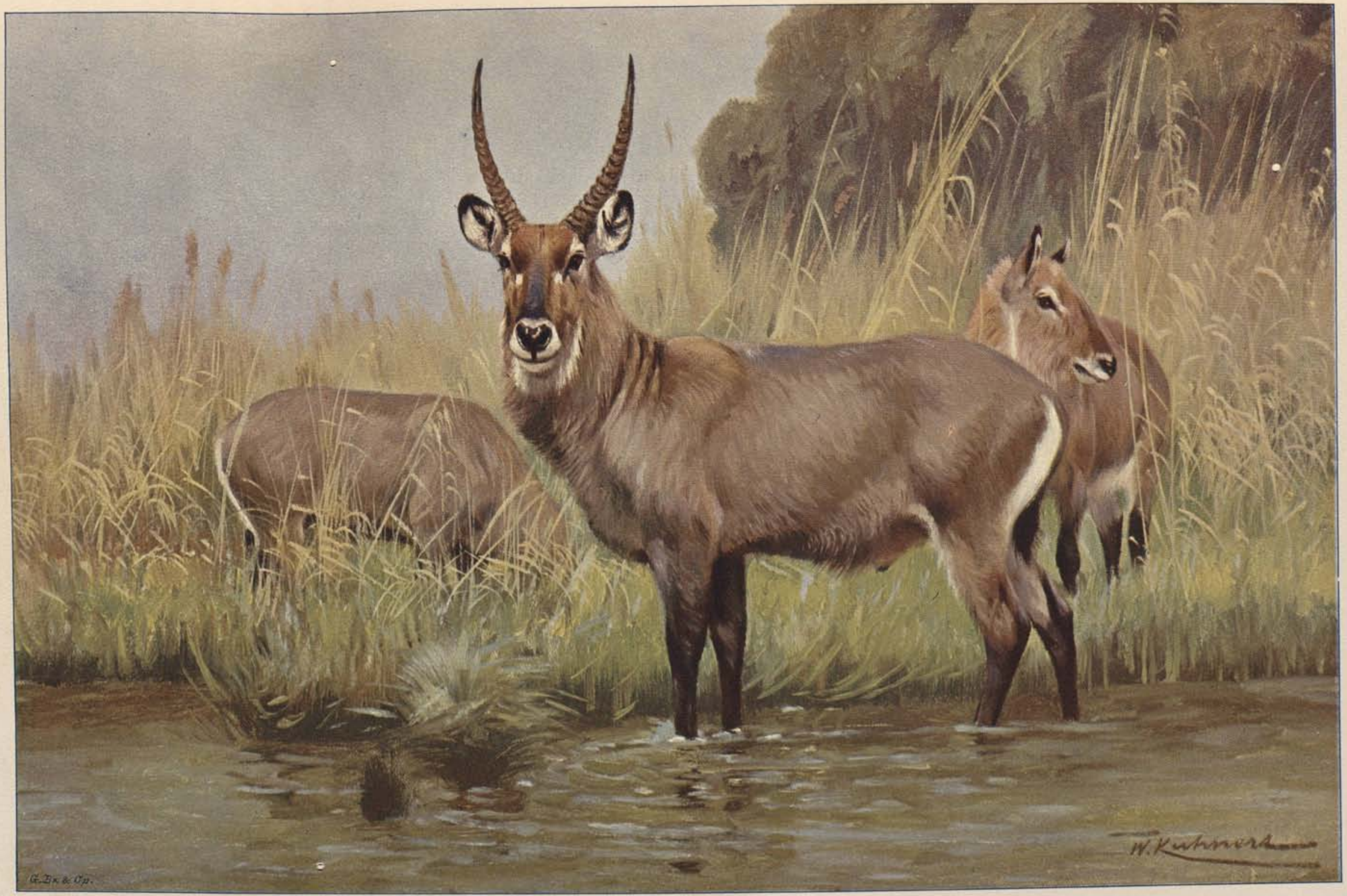
Reedbucks.

Another group of antelopes is typified by the reedbuck (*Cervicapra arundinum*), which ranges eastwards from Rhodesia to Portuguese East Africa, and southwards through Rhodesia, the Transvaal, and Natal to the south-east of Cape Colony. Like palas, reedbucks, of which there are several kinds, are unknown out of Ethiopian Africa. The group is characterised by the forwardly curving horns of the bucks, the moderately long, bushy tail, generally rufous colour, and the presence of a bare patch of glandular skin behind each ear. The typical reedbuck, which stands about 35 inches at the shoulder and has horns of from 12 to 13 inches in average length, is pale foxy red in colour above and whitish below. A pale grey herd inhabits the Lydenburg district of the Transvaal. Reedbuck frequent grassy or reedy valleys, generally in pairs or small parties. A much smaller species is the mountain-reedbuck, or rooi rhebok (*C. fulvorufula*), of eastern Africa south of the Zambesi; and a third is the bohor reedbuck (*C. redunca*), distinguished from the last by the more distinct forward curvature of the horns, which consequently form well-marked hooks. This species has a wide distribution, and is represented by five local races, namely, *C. redunca* of West Africa, *C. r. cottoni* of Kordofan and the White Nile, *C. r. bohor* of central Abyssinia, *C. r. donaldsoni* of the country east of Lado and western Somaliland, and *C. r. wardi* of Uganda and the east coast districts.



BOHOR REEDBUCK.

Waterbucks and Kobs. Nearly allied to the reedbucks is the group of antelopes known as waterbucks and kobs, the former name being restricted to the larger and the latter to the smaller species. In the waterbuck (*Cobus ellipsiprymnus*) the horns of the bucks are long, slightly lyre-shaped, and ringed almost throughout their length, which may be as much as 36½ inches. The range of this large and handsome species extends across the continent from German South-west Africa to East Africa, thence northwards to Somaliland, and as



WATERBUCK.

far south as Zululand and the eastern Transvaal. In height this antelope stands 50 inches at the shoulder, while in length it measures nearly 90 from the muzzle to the tail, which adds another 20 inches to the length. The coarse coat is greyish brown with an elliptical white ring on the buttocks and a white band on the throat extending almost from ear to ear. This species is seldom found far from water, and generally frequents steep, stony hillsides, where it associates in small herds, the females keeping watch, with their ears in constant movement and their eyes always on the alert. When wounded, waterbuck charge and use their horns freely, so that their pursuit is by no means free from danger. As in all the other members of the group, the females are hornless. Nearly allied is the defassa or sing-sing waterbuck (*C. defassa*), distinguished from the typical species by the fine soft rufous coat and the presence of an uninterrupted white patch on the rump which does not reach above the base of the tail, as well as by the absence of the white gorget. Several local races of the defassa, chiefly distinguished by differences of colour, are known; the typical representative of the species being the true defassa of western Abyssinia and Kordofan. Among the other races, it must suffice to refer to *C. d. ugandæ* of the great lake region, the sing-sing or western race (*C. d. unctuosus*) of Senegal and Gambia, the dusky *C. d. crawshayi* of British Central Africa, and the still darker *C. d. penricei* from the interior of the Benguela district of Angola. Among the smaller members of the group, Mrs. Gray's kob (*C. maria*) and the nearly related white-eared kob (*C. leucotis*) of the papyrus-swamps of the White Nile are conspicuous on account of the white ears and blackish brown coats of the adult males; the females and young males being foxy. The first named of these species has longer and more twisted horns than the second. In the Bahr-el-Ghazal province the white-eared species is represented by Vaughan's kob (*C. vaughani*), in which the foxy coat seems to be permanently retained. Of smaller size and stouter build is the foxy red Buffon's kob (*C. coba*), in which the backs of the ears are of the same colour as the neck. This species is typically from the west coast, but is represented by a rather larger race (*C. c. thomasi*) in Uganda. Not improbably Vaughan's kob and the white-eared kob are nothing more than local races of this species. In Buffon's kob the fronts of the fore-legs are black, but these dark markings are lacking in the rough-haired puku (*C. vardoni*) of the Chobi and Zambesi valleys and parts of Rhodesia. Considerably larger is the lechwi (*C. leche*), of Zambesia and Barotsiland, which may be recognised by its much longer and more slender horns, black-fronted legs, and the bare hind-surfaces of the pasterns. Finally, the black lechwi (*C. smithemani*), of the Lake Mweru district, may be regarded as a lechwi on the way to assume a sable livery like that of Mrs. Gray's and the white-eared kob. Lechwi are swamp-dwelling antelopes, which frequently stand up to their necks in water, although, however deeply immersed, they always progress by leaps, accompanied by great splashing, instead of swimming.

Rhebok.

A distant relative of the waterbucks and kobs is the rhebok, or vaal rhebok (*Pelea capreolus*), ranging from the Limpopo to Table Mountain, but somewhat local in its distribution. Easily recognised by its grey-fawn coat and the comparatively short, dagger-like, upright horns of the bucks, the rhebok stands less than 30 inches at the shoulder, while the head and body do not exceed 4 feet in length. From 7 to 11 inches is the range of length of the horns of the bucks; these appendages, as in the waterbuck group, being confined to the male sex. Rhebok are mountain-antelopes, very similar in the matter of habits to chamois. Usually they associate in small flocks of from six to seven, although occasionally so many as a dozen may be seen in company. Keeping to the barren *kopjes* and rocky ranges, and descending to the valleys only in search of water, they feed in the early morning; an old buck being reported to be on duty as sentinel on all occasions.

Klipspringer.

The expressive name of klipspringer (=rock-jumper) was applied by the early Boer settlers to a pretty little gold-spangled mountain-antelope which they saw springing from rock to rock and from crag to crag, as though its joints were of wire and its hoofs of indiarubber. This species (*Oreotragus saltator*), which ranges from the Cape to Abyssinia, and stands only about 23 inches in height, with horns of from 3 to 5 inches in length, and large ears, is the first representative of a group of small Ethiopian antelopes comprising several genera, in all of which the females are normally hornless. The klipspringer may be recognised by its gold-spangled coat of short stiff hair, and short blunt hoofs, on the tips of which it stands. Klipspringers are able to climb precipitous cliffs, and are always found on rocky ground, generally on hills, but occasionally in river-valleys. They associate in small parties, feeding on grasses and mountain-plants, and leaving their rocky haunts only at night, and then merely to drink.

In the East African klipspringer, *O. s. schillingsi*, the females are horned. A klipspringer from the Duchi 'n Wai range of the Yola province of northern Nigeria, lying to the south-west of Lake Chad, has been named *O. s. porteusi*, and is of interest as showing that the species ranges into West Africa. Klipspringers, it appears, are quite familiar to the natives working in the Yola tin mines, by whom they are known as *gaddi-dueki*, a term equivalent to hill-duiker.

Steinbok and Pigmy Antelopes.

Although widely distributed in South Africa, from the Zambesi to the Cape, the well-known steinbok (*Rhaphiceros campestris*) is but seldom seen on account of its wonderful capacity for concealment. Slender in build, its general colour is rufous brown with white buttocks and under-parts. In height it stands about 20 inches, and the length, inclusive of the very short tail, is about a yard; the smooth black horns of the bucks measuring from 4 to 6 inches. In the steinbok the lateral hoofs are wanting, but they are retained in its South African cousin the grysbok (*R. melanotis*), a grizzled red species ranging as far north as the Zambesi and Mozambique. An intermediate species is Sharpe's steinbok (*R. sharpei*), of Nyasaland and Rhodesia, which combines the grizzled coat of a grysbok with the absence of the lateral hoofs. Steinbok frequent sparsely wooded districts, and avoid mountain-forests, feeding in the early mornings and evenings, and going for days without water.

The pigmy antelopes (*Neotragus*) are typified by the royal antelope (*N. pygmæus*) of the Guinea coast, which is the smallest of the hollow-horned ruminants, standing only about 1 foot at the shoulder, with quite minute horns.

Intermediate between the royal antelope and the under-mentioned sunis are *N. batesi* from the Cameruns and *N. harrisoni* of the Semliki Valley. Skull-characters are the chief distinguishing features of the sunis, of which one species, *N. moschatus*, inhabits part of the mainland of Zanzibar and two small islands off the coast, while the second, *N. livingstonianus*, ranges from Mozambique to Zululand, where it is represented by a special local race.

Oribi. The Cape oribi (*Oribia scoparia*) is the typical representative of another genus containing several species of sandy-coloured antelopes of considerably larger size than the members of the preceding group. Oribis are recognisable by a bare patch of glandular skin behind each ear, thus recalling the reedbucks; and have no tuft of hair on the crown of the head. The typical Cape species, which stands about 24 inches at the shoulder, is of an earthy yellow and white colour, thereby closely resembling the ground of the districts in which it is found. Among other species may be mentioned the Abyssinian oribi (*O. montana*), the black-tailed *O. nigricaudata* of Senegal and Gambia, and the East African *O. haggardi*, specially distinguished by the unusually stout horns of the bucks.

Dikdiks. The African shore of the Red Sea and the coast range of Abyssinia, as well as the adjacent districts of Somaliland, are the homes of a curious little antelope known to the Arabs either as the Beni-Israel or the dikdik, and to naturalists as Salt's dikdik (*Madoqua saltiana*). This species typifies a genus, all the members of which are characterised by the inflation and trunk-like form of the muzzle, although there is a certain amount of specific variation in regard to the degree of development of this feature. In height this diminutive antelope stands only 14 or 15 inches. Other species inhabit particular districts of Somaliland; while to the southward, in addition to other East African species, the group is represented in Damaraland by *M. damarensis*, and by *M. naso-guttata* in the Lake Baringo area. *M. guentheri* of Somaliland is a well-known representative of the group in which the nose is most trunk-like; this group constituting the subgenus (or genus) *Rhynchotragus*.

Beira. A small mountain antelope from Somaliland, characterised by the large size of its hoofs, and known as the beira (*Dorgatragus mengesi*), is believed to be related to the dikdiks, although at one time associated with the gazelles.

Duikerboks. The duikerboks, so called from the movements of the typical southern species, form a totally distinct group of antelopes, characterised by the presence of tufts of hair at the base of the small straight horns (generally present in both sexes), and the long series of pores formed by the face-glands below the eyes. The typical duikerbok (*Cephalophus grimmi*), which ranges from Cape Colony to Angola on the west and Somaliland and Abyssinia on the east, stands about 23 inches at the withers, and measures in length of head and body about 39 inches, with an additional 3 to 5 inches for the tail. The black horns are straight and slender, smooth at the tips and roughened at the bases, with a length of from 4 to 5 inches. This species is more abundant near the coast than inland, particularly on plains with plenty of covert. When pursued, it leaps high, as if to see above the bushes in which it shelters during the day. As is the case with several other antelopes, the duiker is almost a total abstainer from water. Through Zululand, Natal, the Transvaal, Swaziland, and along the east coast as far as Zanzibar ranges the red duiker (*C. natalensis*), a more rufous species, with the tuft round the bases of the horns more conspicuous, and shorter horns, of about 3 inches in length in the bucks. Standing 17 inches at the withers, it measures, inclusive of the tail, in length about 37 inches. This is a forest species, dwelling near water, and only appearing in the open in wet weather or at the close of the day.

THE DUIKER BOK.

Its cry is a kind of whistle, but it utters a sniffing as it runs. Smallest of South African antelopes is the blue duiker (*C. monticola*), which stands only 14 inches at the shoulder, and measures about 24 inches in length, exclusive of the tail. The horns rarely reach 2 inches in length and are hardly visible above the tuft of hairs. This species is met with in the woods of the eastern coast in Cape Colony, Natal, and Zululand, where it feeds on berries and shrubs. It is apparently on the move throughout the day, although most often seen in the evening and early morning. The West African banded duiker (*C. doriæ*) deserves special mention
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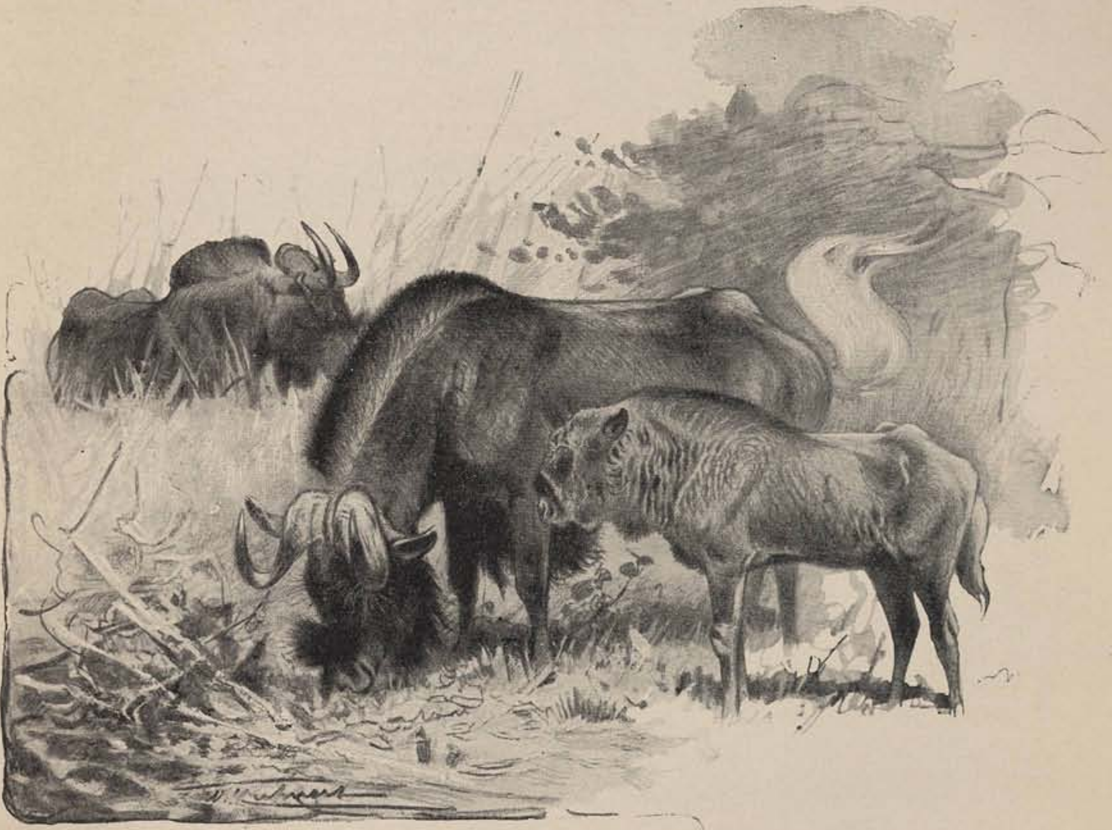
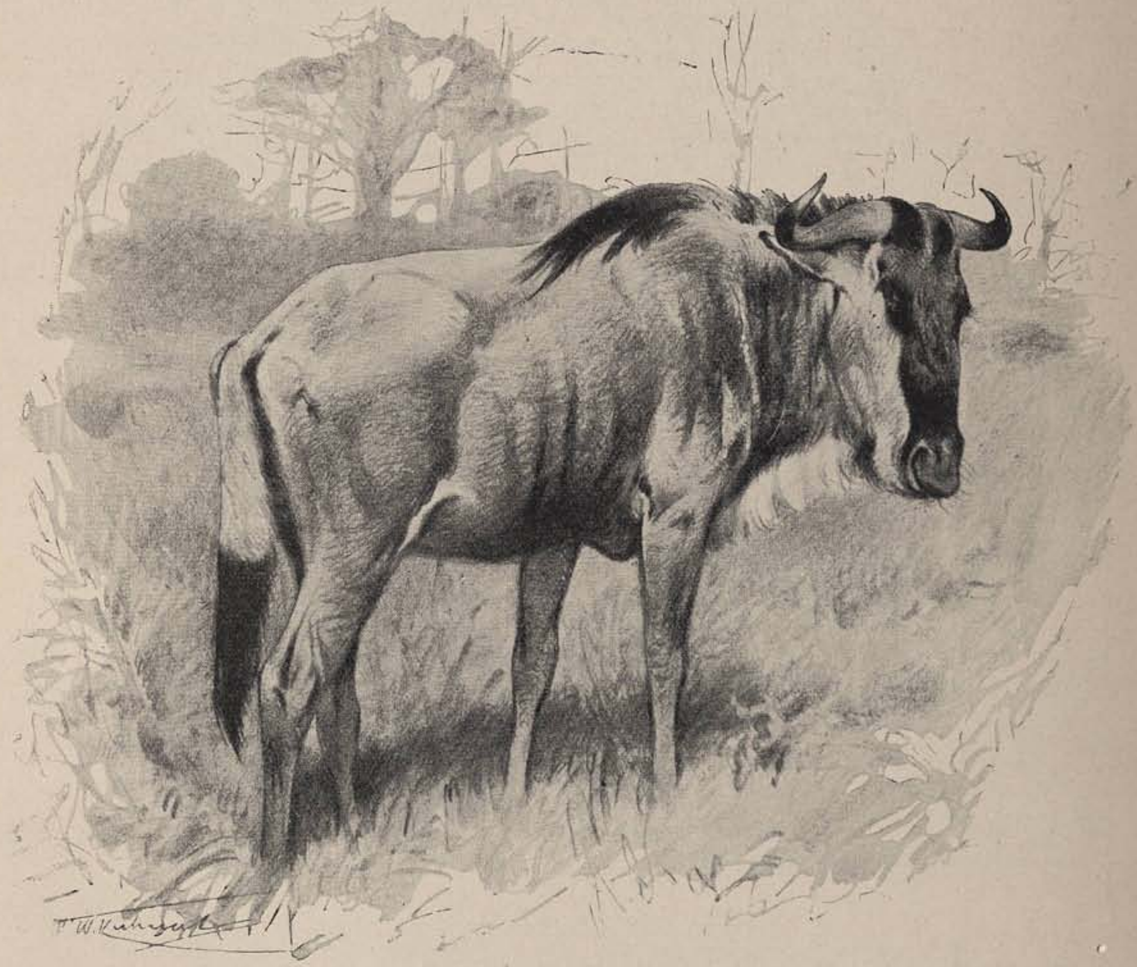
on account of its remarkable coloration. Rather larger than the Cape species, it has the ground-colour golden-brown, upon which on the hinder part of the back are eight or nine black transverse stripes. The yellow-backed duiker (*C. sylvicultor*), which ranges from the Gabun and Sierra Leone to Rhodesia, is the largest of the group, the height at the shoulder exceeding 34 inches. In colour it is blackish grey with a line of erectile yellow hairs along the hind part of the back. Somewhat smaller is Jentink's duiker (*C. jentinki*), of Liberia, which is mainly grey, with the head and throat black, and the legs, lips, and interior of the ears whitish. It should be added that the species mentioned form only a small proportion of those which have been described. The name duikerbok is derived from the Dutch word duiker, signifying a diver, and commonly applied at the Cape to the South African cormorant. Duikerbok therefore denotes the antelope that dives into covert, and not, as has been suggested, one that dodges or doubles.


WHITE-TAILED GNUS.

Gnus.

With the white-tailed gnu, or black wildebeest (*Connochætes gnu*), we reach the last group of antelopes, which includes both the gnus and the hartebeests. This species, which once extended from a little north of the Vaal River to the south of Cape Colony, has of late years survived only on a few farms north of the Orange River, and may by this time be almost exterminated. Possibly a few remain in the Kalahari or German South-east Africa. It is characterised by its broad, ugly head and down-curving horns, the great height of the withers as compared with the haunches, the upright mane, and the white horse-like tail. The horns, which are present in both sexes, are devoid of rings, and have broad, thick bases, whence they curve downwards and forwards and then upwards, the tips rarely rising to the level of the top of the head in the adult. The Hottentot name gnu is derived from its call, which is a sort of snort sounding like "gnu." These animals are denizens of open plains near water, and have a characteristic habit of kneeling as they feed. When excited, they prance and leap in an extraordinary manner, chasing one another round and round, and indulging in other strange caperings which have been described by many travellers. The tail, with its long plume, measures about 35 inches; the head and body are over 6 feet in length, and the shoulder-height is about 42 inches in the bulls and about 6 inches less in the cows. The horns, which somewhat recall at their bases those of a buffalo, may reach as much as 30 inches along the curve.



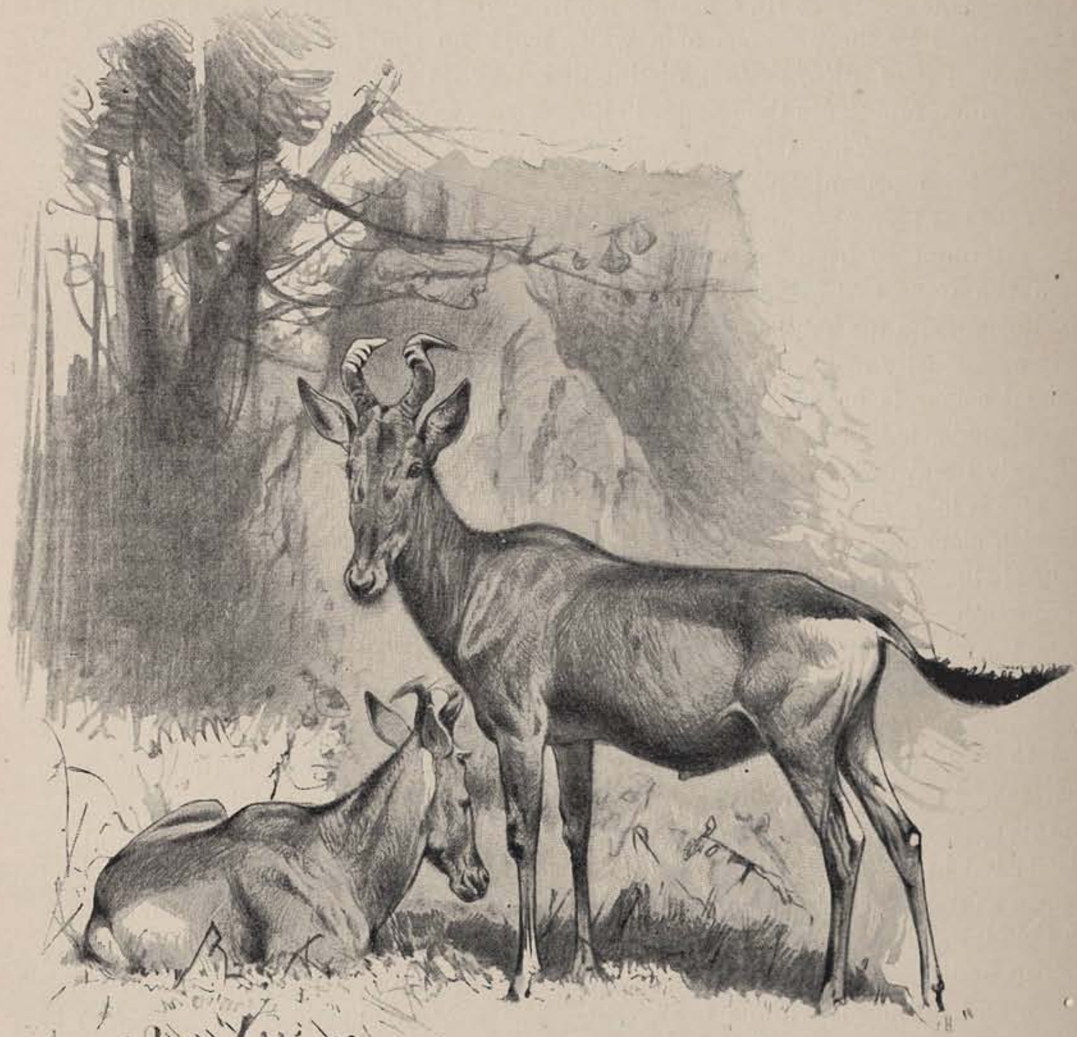
EAST AFRICAN BRINDLED GNU.

The second representative of the genus is the brindled gnu, or blue wildebeest (*C. taurinus*), a larger animal, now scarce in the southern part of its range, which extends from the Orange River Colony into German South-east Africa, Portuguese East Africa, and through Rhodesia, where in some districts it is still comparatively common up to the Zambesi, beyond which it is represented by local races. Although heavier in build and clumsier in its movements than the white tailed species, it has very similar habits. The tail exceeds 3 feet in length, the head and body measure 7½ feet in length, the shoulder-height exceeds 4 feet, and the horns may reach 33 inches along the curve in the bulls. The colour is dark bluish grey marked with vertical dark stripes. The horns are quite different in their curvature from those of the white-tailed species, and more like those of a buffalo. The tail is dark. One local race (*C. t. johnstoni*), from the plains north of the Zambesi, is characterised by the presence of a white mark on the face below the eyes. A second race (*C. t. albojubatus*), distinguished by its light colour and the whitish throat-fringe, represents the species in East Africa to the northward of Kilimanjaro.

Hartebeests.

The Cape hartebeest (*Bubalis cama*) is the southernmost representative of a group of antelopes allied to the gnus, to which reference has been already made in the chapter on North Africa. The Cape species, now exterminated from the greater part of its habitat, which originally extended from the Cape to the Limpopo, has become rare in the Orange River Colony, Basutoland, and the Transvaal. A few are, however, kept on farms in Natal, and it is occasionally met with as far north as Matabililand and Mashonaland. The general colour is brownish rufous, with blackish markings on the face and limbs. The shoulder-height is about 48 inches, and the horns are V-shaped and bent suddenly backwards, with their supporting pedicle very tall. As in all hartebeests, the face is long, and the hind-quarters fall away. Nearly allied, but lacking the blackish markings on the face and legs, is the lelwel hartebeest (*B. lelwel*) of the Bahr-el-Ghazal, of which *B. l. jacksoni* of the Victoria Nyanza district forms a local race; another member of the same group being Neumann's hartebeest (*B. neumanni*) from the north end of Lake Rudolf. In addition to the high horn-pedicle, the horns of the bulls of the two species last named form a V when viewed from in front. A second group is typified by the tora hartebeest (*B. tora*) of Abyssinia and the southern part of the valley of the Blue Nile, in which the pedicle is shorter and the horns are divergent and shaped like an inverted bracket (⏞). In this species the general colour is pale tawny with the chin and tail-fringe alone black; but in the nearly allied sig (*B. swaynei*) of the barren plains of Somaliland known as the Haud, the general colour is darker, and there are blackish markings on the face and legs. A third member of this group is the kongoni (*B. cokei*), of British and German East Africa, characterised by its relatively short and thick horns, and uniformly rufous fawn coat. The western hartebeest (*B. major*) of Senegambia, already alluded to in the preceding chapter, is a large red species with V-shaped horns and a low pedicle. Finally, the konzi (*B. lichtensteini*), which is uniformly yellow tawny, represents a group by itself, and is easily recognised by the great basal expansion and flatness of the horns, which are much curved inwards before the terminal backward bend, and are supported on a low, wide pedicle. Mashonaland, Barotsiland, and Nyasaland are the homes of this unmistakable species.

With the herola (*Damaliscus hunteri*) we come to a second genus of hartebeest-like antelopes, typified by the South African sassabi. In none of them are the peculiarities characteristic of the more typical hartebeests fully developed, as is suggested by the Boer name of bastard hartebeest for the sassabi. The herola, which ranges from southern Somaliland to the north bank of the Tana, and stands about 4 feet at the withers, is easily recognised by the spectacle-shaped white markings between and around the eyes, and the peculiar shape of the long, slender horns. The latter curve at first outwards and then point straight upwards; the long straight terminal portion being devoid of rings. The korrigum (*D. corrigum*) of Senegal is the typical race of a short and thick horned dark red species with a blackish face-blaze and dark limb-markings, which extends across the continent to Kordofan and Uganda, where its local races are respectively known as the tiang (*D. c. tiang*) and the topi (*D. c. jimela*). Most of these antelopes are swamp-dwellers, the name tiang meaning, in Suahili, mud; but another race (*D. c. jonesi*) of the upper part of the eastern Sudan, which is browner in colour, is stated to be a desert animal. In the korrigum the horns, which are ringed nearly to their tips,



CAPE HARTEBEESTS.

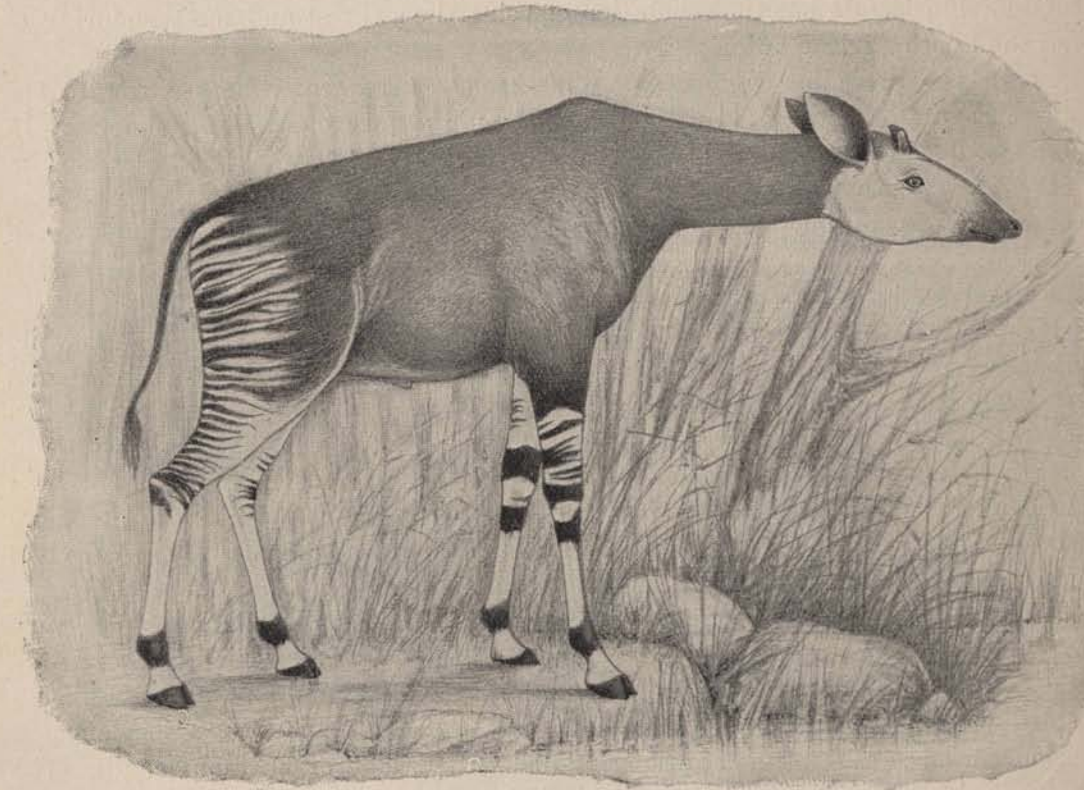
have mainly an upward direction, with a distinct forward curve at starting; but in the South African sassabi (*D. lunatus*) these appendages are not only more slender, but their direction is mainly outwards, with the tips incurving so as to enclose a somewhat lyrate space. Standing about 4 feet in height at the withers, and measuring nearly 7 feet to the root of the tail, the sassabi has a chocolate-brown coat, shading into black on the back, and with a dark blaze on the face. Its range originally extended from Barotsiland southwards into the Transvaal, Portuguese East Africa, and probably Swaziland, but it is now rare throughout its habitat. As a rule, it frequents flat, open country devoid of covert, but when found in forest-districts, is restricted to open glades between the trees. It associates in herds, which are usually small, but in Matabililand formerly included hundreds of individuals. It has the reputation of being the swiftest and most enduring of all the South African antelopes.

In the preceding paragraphs reference has frequently been made to the presence of a broad black streak or "blaze" on the face of African antelopes. In the two last members of the group, the bontebok (*D. pygargus*) and the blesbok (*D. albifrons*), this dark blaze is, for some unknown reason, replaced by a white one, although in immature animals it is dark. These two nearly allied South African species have purplish coats relieved by the aforesaid white blaze on the face and white limbs and under-parts. The two species are sufficiently distinguished by the presence in the bontebok and the absence in the blesbok of a white rump-patch, which includes the upper portion of the tail. The latter species formerly occurred in millions on the plains to the south of the Limpopo, which apparently formed the northern limit of its range. It is now on the verge of extermination, and would probably have already ceased to exist had it not been locally protected. Still nearer extinction is the bontebok, which had a more southern distribution and never extended north of the Vaal River: it now survives in its native land only in a protected state on one farm in Cape Colony.

Okapi.

Ethiopian Africa at the present day is the sole habitat of a very remarkable family of ruminants—the *Giraffidæ*—now represented by the giraffes and the okapi, both of which are long-legged and long-necked animals, standing considerably higher at the withers than at the rump, with elongated slender heads, and short-haired tapering and tufted tails of medium length. The skull is characterised by the remarkable lightness of its constituent bones, which are more or less inflated in the neighbourhood of the forehead, and also by the great length and slenderness of the lower jaw, the front teeth in which are separated by a long gap from those of the cheek-series. The latter, in both jaws, are coated with a characteristically rough enamel; while the four pairs of lower front teeth, of which the three middle pairs represent the incisors and the outer pair the canines of the Carnivora, have much-expanded crowns with a similar rough enamel. The crowns of the outer pair are, moreover, bilobed, instead of simple, and thus differ from the corresponding teeth of all other ruminants. The tongue is long and strap-like, so that it can be protruded a considerable distance in advance of the lips. Skin-covered horns are present in the males, and in the case of the giraffes in both sexes; these consist of bony pedicles, apparently corresponding to the pedicles supporting the antlers of the deer; they are, however, at least in early life, separable from the bones of the skull. In the okapi these skin-covered horns are surmounted by small caps of bare bone representing the antlers of the deer. The small lateral pair of hoofs is absent on both fore and hind feet.

In addition to its remarkable type of colouring, the okapi is characterised by the presence of horns in the male alone, the relatively short limbs and neck, as compared with those of giraffes, and the absence of a mane on the neck. It consequently represents a genus by itself, of which there is but one species, *Ocapia johnstoni*. In height the okapi stands about 5 feet at the shoulder, and has the ears, in conformity to its forest-dwelling habits, much broader than in the giraffe.



OKAPI.

The head has a somewhat convex profile, and a narrow, rounded muzzle. The eyes are proportionately smaller and less prominent than in giraffes; the horns of the males are some 3 or 4 inches in length, compressed, somewhat recurved, and, as already mentioned, capped when adult with small knobs of yellow bone. Compared with the vaulted and swollen skull of a giraffe, that of the okapi is flat and depressed. The tapering tail just reaches the hocks.

The most remarkable external feature of the okapi is its colouring. The prevailing tint of part of the forehead, the ears, neck, and the whole of the body except a portion of the hind-quarters, is purplish brown. This is replaced on the sides of the face by puce or fawn, and on the forehead and ears by dark rufous, while the muzzle is blackish. The hind and lower parts of the buttocks and the limbs as far down as the knees and hocks are transversely barred with broad black and narrow white stripes arranged irregularly. Below the knees and hocks, the limbs, with the exception of a black-banded ring round each pastern and a black stripe down the front of each fore-leg, are white. A certain amount of individual variation is noticeable in regard to the markings on the knees.

The geographical range of the okapi, so far as at present ascertained, comprises the western portion of the great Congo forest, more especially the outer fringe, and extends from the Welle River on the southern verge of the Bahr-el-Ghazal province to the Semliki Valley.

Information with regard to the mode of life of the okapi is still comparatively imperfect, although it is ascertained that the species is extremely shy and retiring, and lives in such situations that it is almost impossible for a European to obtain even a glimpse of it in the living state. The following brief account of the animal's habits were given by one of the members of the ill-fated Alexander-Gosling expedition from the Congo to the Nile:—

"The okapi here is generally found singly or in pairs, but Mobatti hunters state that sometimes three may be found together. An essential to the life of the okapi is a small stream of water with some muddy and swampy ground on either side. In this grows a certain large leaf that on its single stalk attains a height of 10 feet. It is the young leaf of this plant that is the favourite food of the okapi, and I venture to say that where the plant is not to be found the animal will not exist. During the night he will wander along in the mud and water in search of it. Here he may be found feeding as late as 8 a.m. in the morning, after which he retires to the seclusion of the forest, where he remains till nearly dusk. On the three occasions that I was at close quarters with the beast he was perfectly concealed in this swamp leaf."

Like most forest-dwelling animals, okapis go about with the neck stretched out and the head carried low. Their peculiar type of colouring is doubtless of a protective nature, the striping of the legs and hind-quarters tending to break up and obscure the outline of the animal, and thus render it more or less completely invisible in covert.

Giraffes.

Equally protective is the spotted or net-like pattern of the skin of the giraffe, of which the spotted type harmonises with the irregular splashes of light and shade cast by the sun's rays piercing the groves of tall mimosas among which these graceful animals so often dwell. In addition to this characteristic type of colouring, giraffes differ from the okapi by their much greater length of neck and limb, the inflated and vaulted skull, the large and full eye, the presence of horns in both sexes and the absence from their summits of a cap of uncovered bone, as well as by the frequent development of an unpaired horn-like protuberance in the middle line of the face.

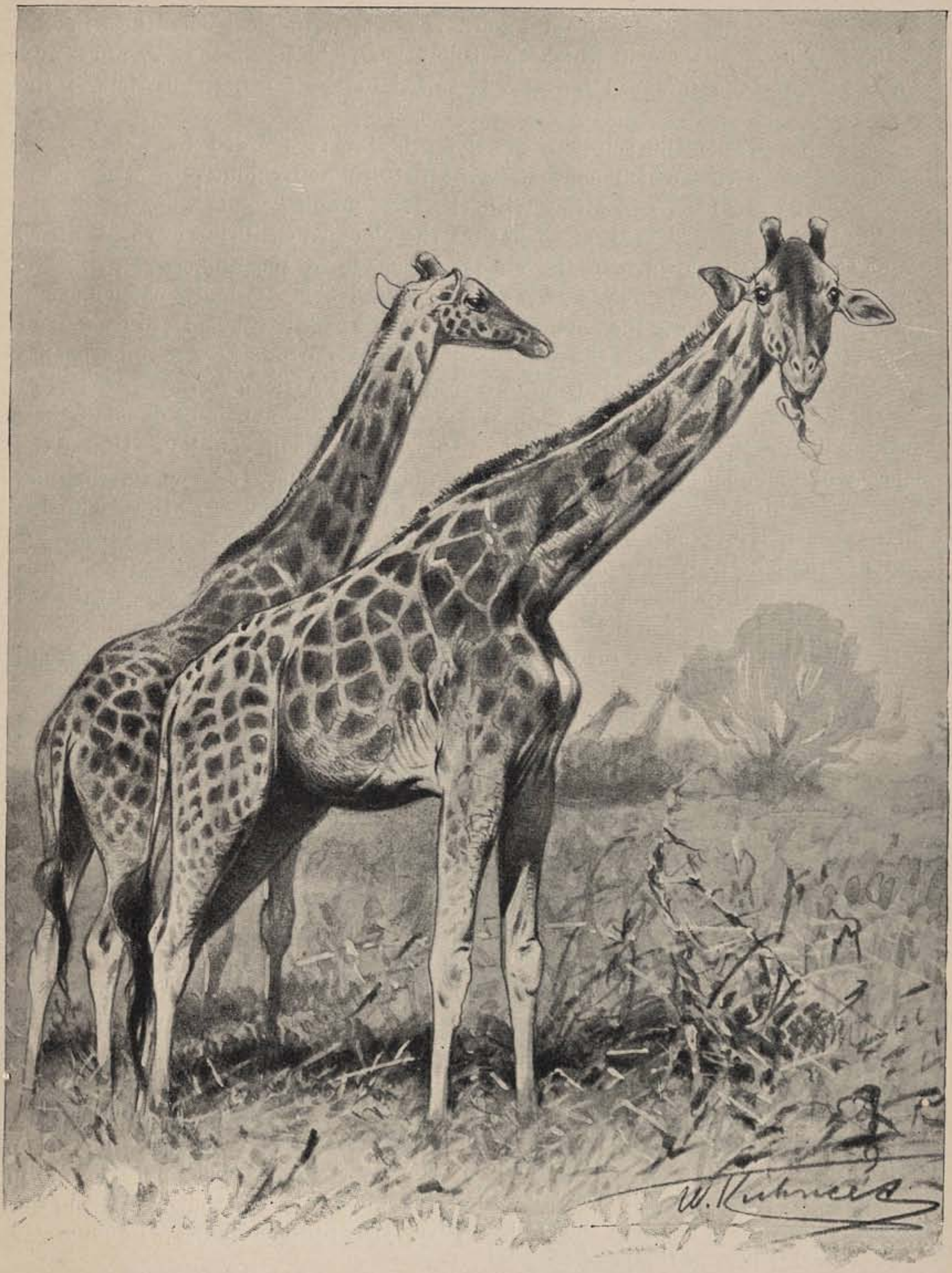
Considerable interest attaches to the evolution of our knowledge of the local variation presented by giraffes. Apparently the first specimen received in England was a skin and part of the skeleton sent by Lieutenant W. Paterson, who travelled in the Hottentot country between 1777 and 1779. This skin was exhibited in the British Museum till about 1843. In 1827 a living giraffe was sent to George IV. at Windsor by the Pasha of Egypt, of which there is a painting in the Royal collection. In 1836 the Zoological Gardens received four giraffes from the Sudan whose descendants flourished till 1892.

Although so far back as 1827 it had been recognised that the South African and the Nubian giraffes were distinct, naturalists till a few years ago ignored the difference, and were content to regard all giraffes as representing *Giraffa camelopardalis* of Linnæus, which is based on the light-coloured, white-legged, and three-horned race from Nubia. The subject of the distinction between the northern and southern giraffes was, however, revived by an English naturalist, who pointed out that, while the former is marked by whitish lines on a chestnut ground and has the lower part of the legs white and carries a horn on the forehead, the latter has chocolate blotches on a buff ground, the legs tawny and spotted to the fetlocks, and no third horn. At the same time was described, as *G. reticulata*, the Somali giraffe, of Somaliland and the Lake Rudolf district, a species characterised by the coarse network of white lines on a liver-coloured ground.

Next came the discovery that the giraffe of Mount Elgon is furnished with rudimentary horns on the back of the head, and is thus five-horned. But it was not till the British Museum received a bull and a cow that it was possible to recognise the distinction of this Baringo race of giraffe (*G. camelopardalis rothschildi*) from other forms of the species. One of its characteristics is the difference between the markings of the two sexes, and the dark colour of the blotches in the bulls; but in its white legs and frontal horn the Baringo giraffe approximates to the Nubian race. In the meanwhile German naturalists had not been idle; and the result of their investigations was to show the distinctness of the Kilimanjaro giraffe (*G. c. tippelskirchi*), which is the most fully spotted of all, and is in many respects intermediate between the northern and southern types having spotted tawny legs, accompanied by a third horn. The star-like form of the spotting is the most distinctive feature of this race. Omitting mention of the Angola, Congo, and Lado races, reference may be made to the Nigerian giraffe (*G. c. peralta*), which is a pale representative of the northern type, characterised by certain peculiarities in the markings. With the southern race (*G. c. capensis*) we come to the blotched type of colouring, that is to say chocolate blotches on a tawny ground; the tawny legs being spotted to the hoofs, and the third horn represented at most by a low swelling.

An interesting intermediate type is presented by the giraffe of north-eastern Rhodesia (*G. c. thornicrofti*), in which while the front horn is represented by a mere boss, as in the North Transvaal giraffe (*G. c. wardi*), the lower part of the legs is tawny with faint indications of spotting. There are likewise differences in the form of the markings on the neck. The Rhodesian giraffe, which is quite isolated, is of great interest as indicating the intimate gradation from the northern and equatorial races towards the southern type.

To put it shortly, the result of modern investigation is to show that instead of there being merely a southern and a northern giraffe, with a modification of the latter in Somaliland, there are a number of local phases which tend to exhibit a transition from the northern to the southern type as we pass down the African continent. That the recognition and description of such local variations has a



GIRAFFES.

certain amount of interest cannot be denied; but it would be an error to regard such recognition as the end of the investigation. The important matter is to find the reason for all these variations, and why an animal with a netted type of coloration, white legs, and a frontal horn is adapted to local conditions in the north of Africa, while one in which the coloration is blotched, the legs are tawny and spotted, and the forehead hornless is suited to the southern districts of the continent.

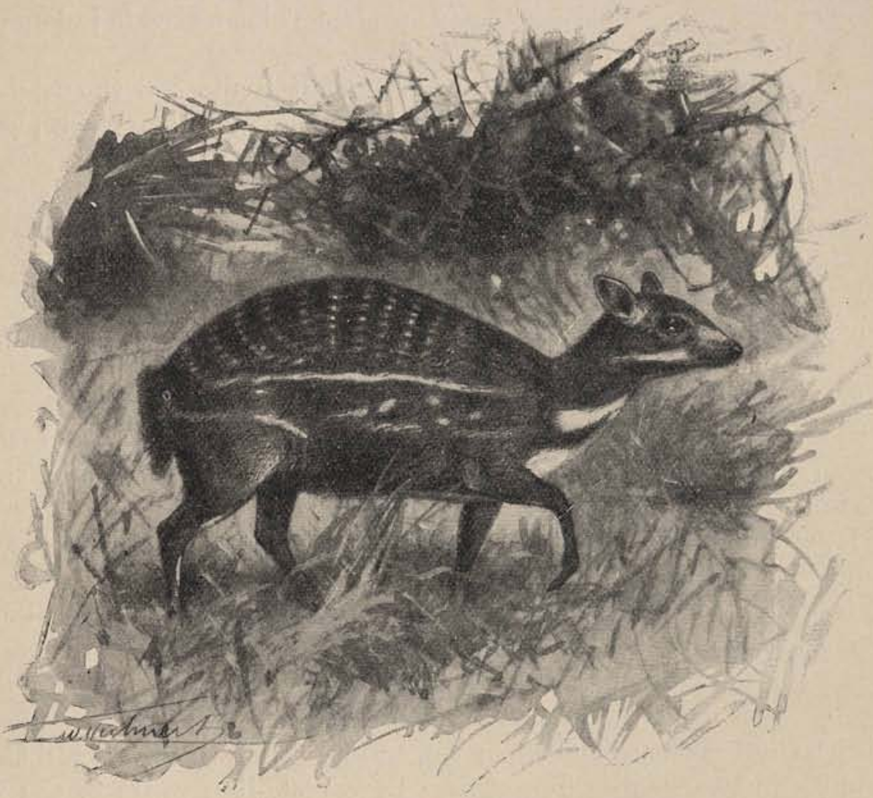
A step towards the solution of the problem is afforded by photographs taken in East Africa, which show that the pattern and colour presented by the Somali giraffe are for harmonising with the bush-jungle among which it dwells. As already mentioned, it is also known that the blotched colouring of the southern giraffe assimilates its owner to the chequered shade of the mimosas on which it feeds, and likewise to the trunks of the trees themselves. Again, its paler hue and white legs may assimilate the northern giraffe to the sandy tint and white shimmer of the Nubian Desert; while the black spots of the Baringo race may harmonise with the darker and richer colouring of a tropical East African forest.

Giraffes depend chiefly upon sight and hearing to warn them of danger; their towering height enabling them to overlook a wide extent of country. Unlike the majority of mammals, giraffes when running, instead of moving one fore-leg and the opposite hind-leg together, move the fore and hind legs of the same side simultaneously; this causes a rolling motion, accompanied by a swaying from side to side of the long neck, the tapering and tufted tail being carried bent forwards over the back. Their only active means of defence appears to be kicking with the fore-legs. Giraffes are definitely known to attain a height of 18 feet to the crown of the head, and there are reports that some old bulls in East Africa tower to 20 feet.

Except in certain parts of eastern and central Africa, and perhaps in a few localities elsewhere, giraffes are becoming very rare, and restricted to isolated and undisturbed localities. In former days they were to be found in considerable numbers over a large tract of country south of the Zambesi, and they were also common in some parts of the Kalahari Desert, as well as in the sandy regions between the Bawangwato and Lake Ngami, and in the district near the Mabebi, Chobi, and Zambesi Rivers. In some parts of the Botletli Valley, and also in the waterless but wooded sandy districts on the south bank of the Chobi, they were particularly numerous; they were also to be met with in the vicinity of Linyanti, between the Chobi and the Zambesi, although not nearly so abundantly, but immediately north of the Zambesi they are unknown, although common in many parts of central and East Africa. Giraffes were once common in many parts of Matabililand, whence they appear to have migrated some years before 1881 to the eastward of the river Gwelo, a tributary of the Zambesi, where both banks are of similar character and the stream consists for the greater part of the year of a series of pools quite easy to cross. The chief region in South Africa where they still occur appears to be the parched plains in the north of the Kalahari, where, in the country immediately south of the Botletli River, they probably exist without water for the greater part of the year.

Water-Chevrotain. As mentioned in the preceding chapter, deer are entirely absent from Ethiopian Africa, and the small family of so-called mouse-deer, or chevrotains (*Tragulidæ*), is represented solely by the water-chevrotain (*Dorcatherium*, or *Hyomoschus*, *aquaticum*), whose range extends across the forest-zone from the west coast to the Ituri forest in the east, where it is represented by a separate race.

In size somewhat superior to the chevrotains (*Tragulus*) of tropical Asia, this species also differs in the structure of the bones of the fore-feet, in which no cannon-bone is formed. In height the animal stands 13 or 14 inches at the shoulder; and in colour it is olive-grey, profusely spotted and streaked with white or yellow, the throat and chest having a number of longitudinal streaks. As their name implies, water-chevrotains frequent the rivers of equatorial Africa, in which they both swim and dive with facility.



WATER-CHEVROTAIN.

Bush-Pigs. Bush-pigs, or river-hogs, form a peculiar group of the swine family (*Suidæ*), restricted to Ethiopian Africa, with the exception of one species in Madagascar, in which island it is probably a comparatively recent immigrant. From typical swine they are distinguished by the absence of the first pair of cheek-teeth in the lower jaw, the simpler structure of those teeth in both jaws, and the presence of two bony ridges on each side of the face, the upper one of which may be sheathed with horn in the old boars. Long tufts of hair surmount the tips of the ears. The typical species, *Potamochœrus chœropotamus*, has a wide range, and is represented by several local races, differing considerably in the matter of colour. It is specially characterised by the great development of the ridges on the skull of adult boars, the upper pair projecting as crests above the line of the face, while those on the sheaths of the tusks reach up to that line.

The southern, or Cape race (*P. c. typicus*), is generally greyish yellow; but in the Lake Mweru district and Nyasaland we find a reddish race (*P. c. nyasæ*), and a third phase (*P. c. dæmonis*) characterises Kilimanjaro and its neighbourhood. Some 30 inches, or a little more, at the shoulder is the height of the boars. A second species, *P. hassama*, is a native of Abyssinia, and is at present chiefly defined by skull-characters. Most remarkable of all is the red river-hog (*P. porcus*), of West Africa, in which the upper ridges on the skulls of the boars have flattened and expanded summits approximately in the line of the plane of the face. The ear-tufts attain great development, and the general colour is bright reddish brown, with much black on the face, and imperfect white spectacle-like rings round the eyes. These gorgeously coloured swine associate in large sounders in well-wooded districts on the banks of rivers.

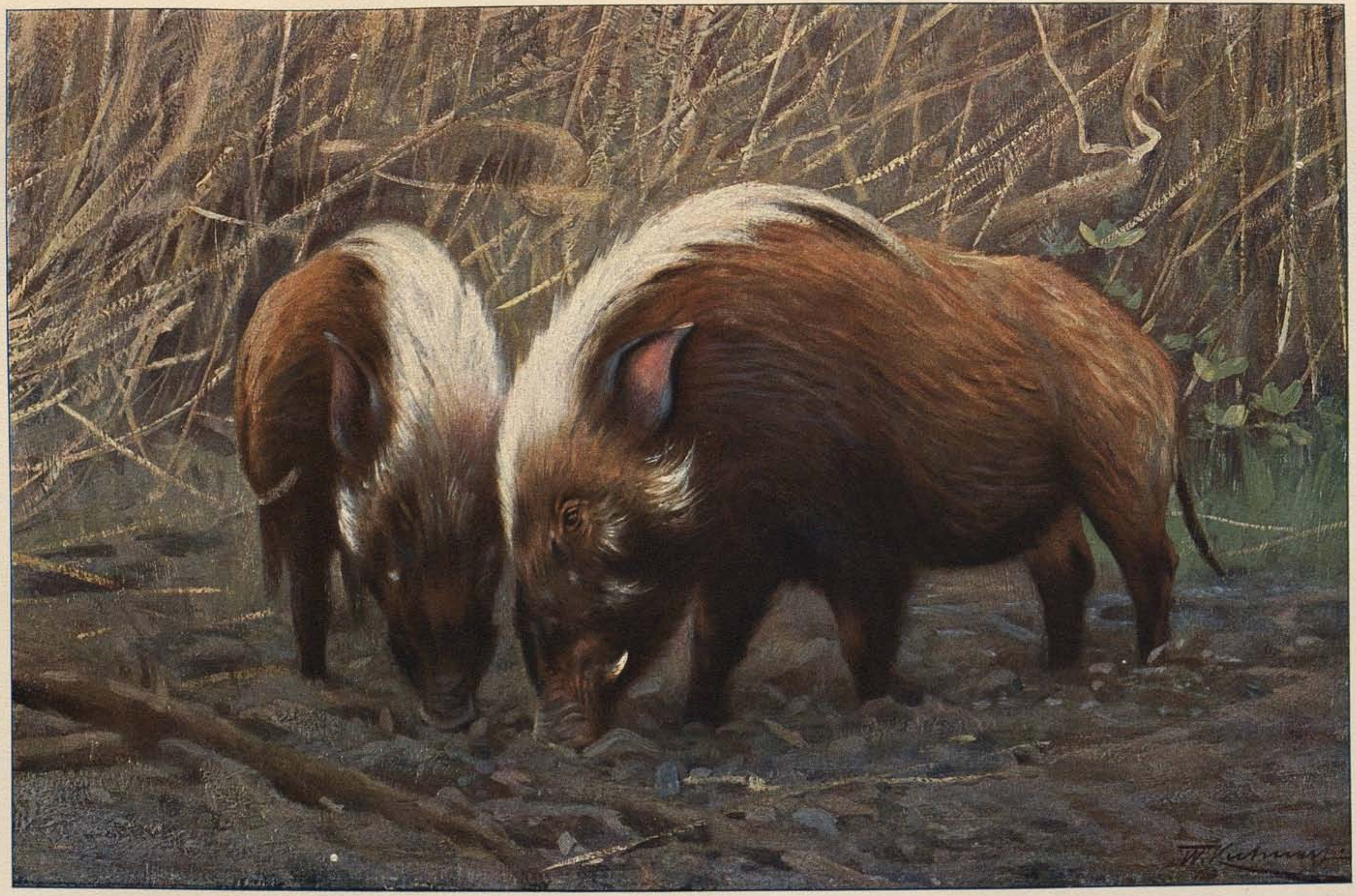
Forest-Hog.

The equatorial forests of Mount Kenia and the Nandi district near the Victoria Nyanza are the homes of a huge black pig, which in some respects presents characters intermediate between the bush-pigs and the under-mentioned wart-hogs. It represents a genus by itself, and has been named *Hylochœrus meinertzhageni*. The forest-hog apparently comes nearest to the wart-hogs, but has a less specialised type of skull and dentition, and thus serves to connect those hideous creatures with more typical swine. The tusks, although very much smaller, have the characteristic curvature of those of the wart-hog, and there is the same reduction in the number of the upper incisors to a single pair; but the coat of long black hair is much more profuse than in the wart-hogs.

The face of the old boars carries a pair of huge flattened warty growths below the eyes recalling those large funguses which grow on decaying tree-trunks. These great fungus-like warty growths correspond to the warts of the wart-hog. In the latter animal there are two pairs of these warts, both of which are conical in shape with a subcircular base. The hind and larger pair arise from rough depressions situated near the middle of the zygomatic or cheek-arch immediately below the eye, while the second and much smaller pair grow from very similar depressions on the sides of the upper jawbones, behind the tusks. In the forest-hog, on the other hand, the whole of the outer surface of the cheek-bone, or cheek-arch, is heavily roughened and expanded, and it is from this surface that the great fungus-like warty growth arises. These huge plate-like warts of the forest-hog therefore clearly correspond with the hind pair of warts of *Phacochœrus*. Whether their front portion does not also represent the front warts of the wart-hog is not easy to decide, although it is possible that such may be the case. Either way, the correspondence of the forest-hog's huge warts with the much smaller hind pair of the wart-hog affords additional evidence of the near affinity of the two genera. In size this swine greatly exceeds any bush-pig or wart-hog. The species is represented by one local race (a species according to its describer) in the Ituri forest, and by a second in the Cameruns district, so that it probably ranges right across the forest-zone.

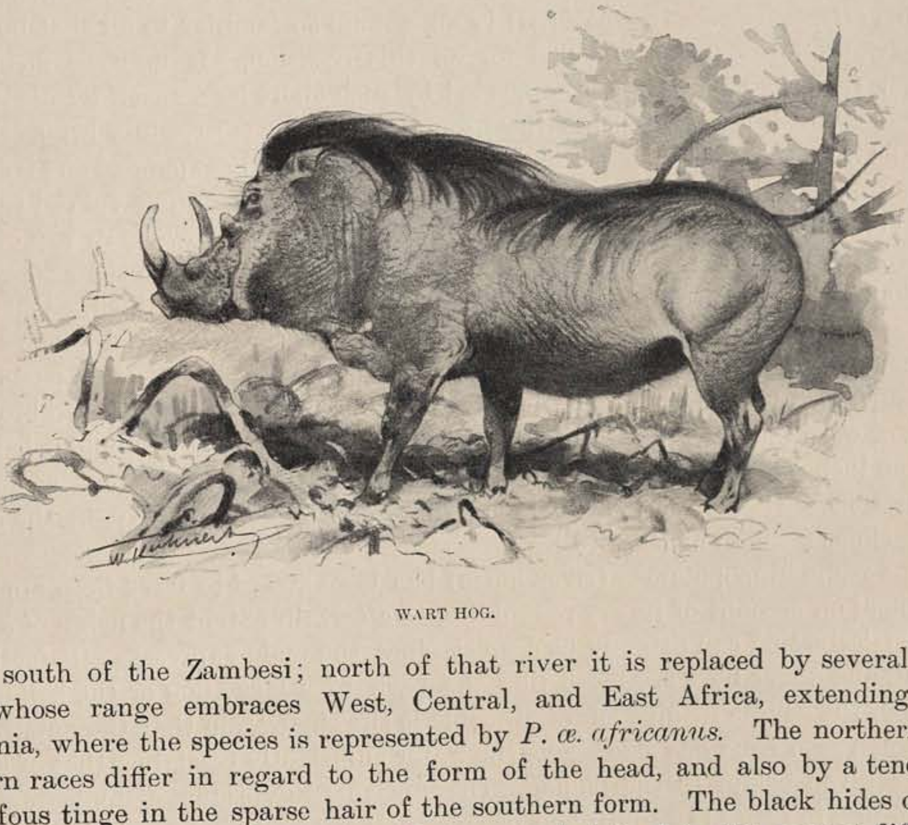
Wart-Hogs.

Very characteristic of Africa south of the Sahara are the wart-hogs, recognisable at a glance by the extraordinary shape of the head, and the huge size and peculiar curvature of the tusks. The huge head is characterised by the length and breadth of the muzzle and the above-mentioned



RIVER-HOG.

conical warts below the eyes and smaller ones between the latter and the tusks. The tusks themselves, which are tipped with enamel only in youth, curve both upwards and inwards, the upper ones frequently measuring as much as 13 inches, although they may be double that length. Unlike those of ordinary wild swine, the upper tusks much exceed the lower pair in length, the latter biting against the lower surface of the former so as not to blunt their points. The upper incisor teeth are reduced to a single pair, but in young animals there are three pairs of lower ones. Old wart-hogs have, however, frequently only the tusks and a single pair of cheek-teeth in each jaw, which are the last of the series, all those in advance, as well as the incisors, being gradually shed. The structure of the very large pair of persistent cheek-teeth, or molars, is very remarkable, although it is really only an exaggeration of the type obtaining in ordinary swine. Typically the wart-hog (*Phacochœrus æthiopicus*) is a native of Africa south of the Zambesi; north of that river it is replaced by several local races, whose range embraces West, Central, and East Africa, extending into Abyssinia, where the species is represented by *P. æ. africanus*. The northern and southern races differ in regard to the form of the head, and also by a tendency to a rufous tinge in the sparse hair of the southern form. The black hides of old animals are nearly bare. Young wart-hogs are not striped, in this respect differing from those of most other wild swine.



WART HOG.

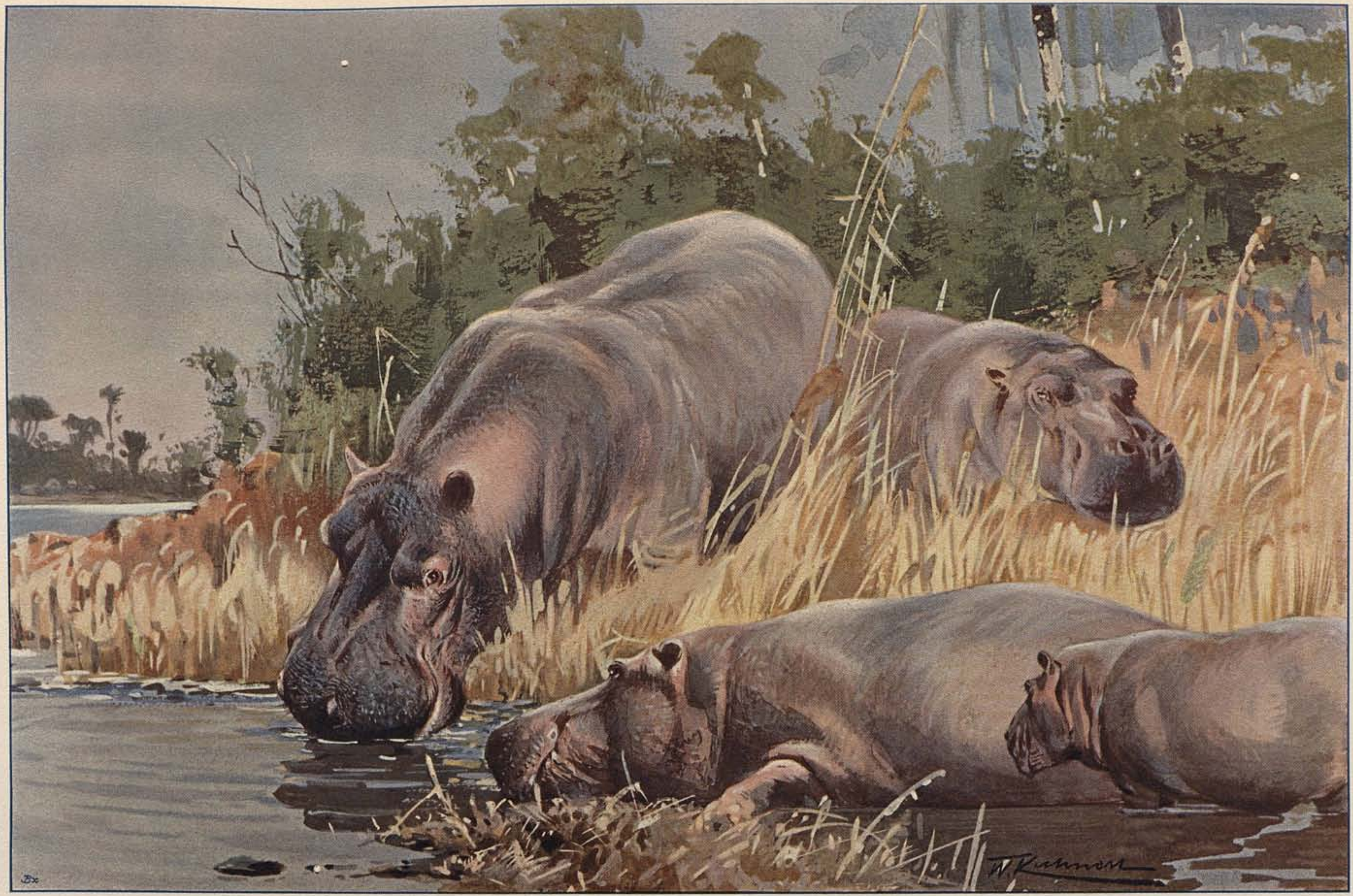
Wart-hogs have much the same general habits as other swine, lurking during the day in thickets and ravines, whence they issue at evening into the open to feed, although even then they prefer to remain in the neighbourhood of covert.

As a rule, these animals associate in herds of from eight to ten head, consisting of the females and young males, the old males living alone. In Abyssinia they use their tusks for the purpose of digging up roots, of which they are very fond, and also for digging holes in the earth, intended probably for the young. These weapons are more rarely used for defence, as the wart-hog, although excitable, and manifesting its excitement by the erect carriage of its tail, is not a courageous animal, and will seldom stand at bay when pursued, even though wounded. When pressed by dogs, it will, however, make a brave stand and inflict severe wounds. In southern and eastern Africa wart-hogs generally occupy the deserted burrows of ant-bears or other animals; and instead of coming straight out are reported to reach the exit by a kind of somersault. Sportsmen unacquainted with this peculiar mode of exit are liable to be severely injured through not standing in the right place to await the occupant of the burrow.

Hippopotamus.

Wart-hogs and the other African swine are classed by naturalists in the family *Suidæ*, but the two species of hippopotamus are regarded as representing by themselves a family—the *Hippopotamidæ*—which is now confined to Ethiopian Africa, although at an earlier epoch of the earth's history it had, like the giraffe family, a much wider range. The ordinary hippopotamus (*Hippopotamus amphibius*) is an animal so familiar to all that but little in the way of description is called for on this occasion. It may be mentioned, however, that the bulky body is supported by such short legs—each terminating in four toes—that it almost touches the ground. The huge, ungainly head, which is generally carried low, is flattened, and terminates in a greatly expanded and truncated muzzle—quite unlike the flattened disc of the swine. Enormous curved tusks, as well as two pairs of incisors, of which the inner ones in the lower jaw are of great size, arm the front of the cavernous mouth. The small eyes and their sockets are remarkably prominent, and the neck is unusually short and thick. Out of the water a hippopotamus appears dark brown, with dirty flesh-coloured patches in the folds of the skin, on the prominent portions of the head, and in certain parts of the lower surface. In the water the usual colour is dull grey, shading to brownish, bluish, or even purple. A length of from 11 to 12 feet, with a shoulder-height of about 56 inches are the dimensions of a good male, whose weight may be as much as four tons. The lower tusks, which are by far the larger, may, in the case of fine specimens, weigh at least 15 lbs.

The name hippopotamus (river-horse) has been stated to have been applied to the animal on account of its cry resembling to a certain extent the neigh of a horse, but this derivation can scarcely be correct since the male expresses satisfaction by a grunt, and anger by a cry more like the bark of a large dog or the bellow of a bull than the equine neigh. More probable is the suggestion that the outstretched head when seen from one side above the water sufficiently resembles that of a horse to have given origin to the name. The ancient Egyptians displayed a truer appreciation in using the equivalent of river-hog as the designation of this animal, which has no sort of kinship with the horse. In former times hippopotamuses were distributed all over Africa as far north as the Sahara, and in the east up to the delta of the Nile, but between the cataracts of that river and the sea they appear never to have been met with in large numbers. When the Dutch first colonised the Cape of Good Hope hippopotamuses were abundant in the country around, but they have now disappeared from the extreme south, although still found in a few places in the Orange River Colony, Natal, the Transvaal, and Portuguese East Africa. On the west coast they occur in the Cunene and the rivers to the



HIPPOPOTAMUS.

north; in the swamps of Lake Ngami they are fairly common; and they abound in the Zambesi, particularly in its upper waters; northwards to the Sahara they are met with in every large river, including the upper Nile. Although in scantily populated districts these animals, instead of doing harm, are said to be of considerable use by keeping down the luxuriant growth of aquatic plants which would otherwise choke the rivers, in cultivated country they do a large amount of damage, not only by trampling down with their feet more than they eat but by rolling on the ground like gigantic swine. In spite of their clumsy build, hippopotamuses swim and dive remarkably well, and have been known to swim some distance out to sea from one river's mouth to another. They spend most of their time in the water, coming to the surface only for a moment to breathe, often in spots so thickly covered with large-leaved lilies and other aquatic plants that their muzzles hardly project above the surface and are often quite concealed from view. As a rule, they rise every minute and a half or so, and only when pursued do they hold their breath for so long as four to five minutes at a time. Although remaining in the water for the greater part of the day, they are fond of sunning themselves at noon on the banks, where the clumsy gambols of the adults, the frolickings of the young, and the affection displayed by the mother for her offspring are best observed. After sunset, if tempted by good pasture, they often wander long distances from the water, and, in spite of their clumsy appearance, will climb steep banks or ravines with astonishing rapidity. In spring the old bulls fight for the possession of the females, the conquerors going off with the objects of their choice. The female produces only one calf at a time, which is born after a gestation of from 227 to 242 days. The mother is devotedly attached to her offspring, carrying it on her back, concealing it in safe places on the bank, and defending it with the greatest fierceness.

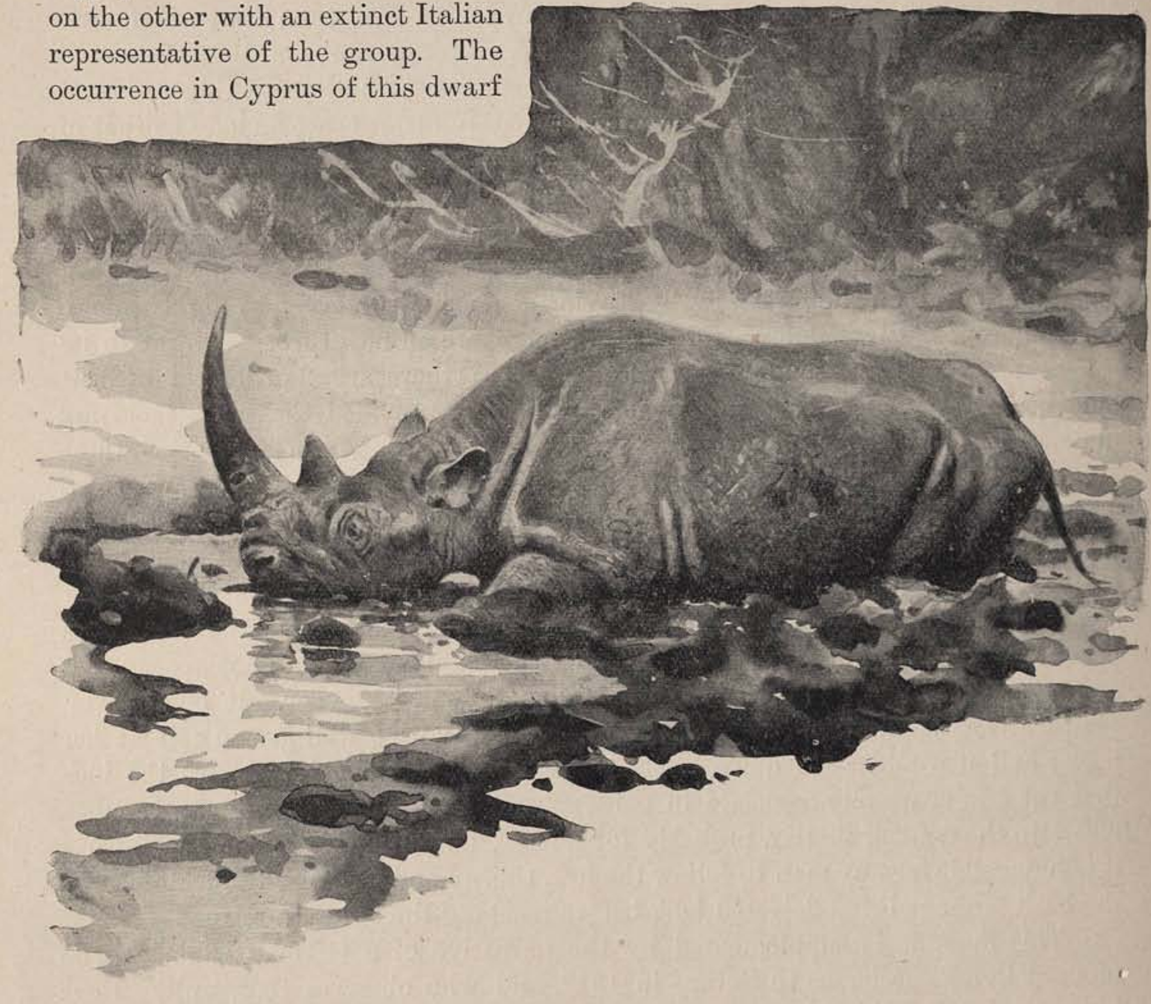
Hippopotamuses have always been eagerly hunted, as their flesh is nourishing and well-flavoured, especially when young, a full-grown animal yielding as much meat as four or five oxen. The lard, or so-called "lake-cow fat," is considered better than pig's lard, being devoid of unpleasant flavour, and is used both for cooking and as an embrocation. The hide, which is fully an inch thick, is usually cut into from four to five hundred strips, which are rubbed with fresh fat to make it supple. From these strips are made the kurbashes and sjamboks, which since the time of Menes have played a great part in the history of Africa. In Khartum these whips are ornamented with silver or tin, and form a considerable article of trade with Egypt, Tripoli, Tunis, and elsewhere. Shields are also fashioned from the hide; and from the tusks, which retain their whiteness and are therefore almost as good as ivory, were formerly manufactured artificial teeth. In the abbey of La Certosa, near Pavia, is an altar-covering carved by Bernardo degli Ubriachi out of hippopotamus teeth.

The following account of hippopotamus-hunting is from the pen of an English traveller. In the dry season of the year the river Setit forms a series of falls, shallows, rock-bound bays, and quiet pools of unknown depth. Into these spots the river-horses retire when they return from their nightly wanderings on land, and one may often hear them snorting without being able to see them. One particular animal had been tracked by natives to a large pool, out of which rose banks of sand and rocky islands, among which were a number of hippopotamuses, including an old male and several females and their young. One young animal stood like an ugly little statue on the rocks above the water, while another had taken up its station on the back of its mother. Two hunters crept within distance, moving quietly towards the spot where the river-horses were sunning themselves, or swimming in the centre of the pool. The hunters swam quietly and swiftly down the stream, and on nearing the rocks dived, to appear a few seconds later close to where the young hippopotamus stood. At the same moment that the animal entered into the water the hunters threw their harpoons, and, diving once more, swam some distance under water and hastened to the bank. One of the harpoons missed, but the second struck the male of the herd, and the wounded animal rose snorting to the surface. As the float attached to the harpoon was unusually large and naturally followed all the movements of the animal, the latter endeavoured to avoid its pursuers and dived constantly, but whenever it appeared above water it saw its pursuers close at hand. The hunters were very excited and called to their companions, who were not far distant. These brought long ropes, and the party made a halt on the bank of the river, while two men swam across with one end of the rope. When they reached the farther bank, the principal rope was fastened to another, so that those on the one side held the ends of two cords, while those on the other side held only one, the connecting point of both forming a sharp angle. On one side two men held a rope, one being about ten yards in advance of the other; and on both sides they began to move, dragging the rope out of the water after them until they came to the float, which was flying hither and thither following the motion of the animal. With the aid of a well-timed jerk of the rope, the float was brought into the sharp angle and fastened there, and while the men on the other bank slipped their end of the rope, the others pulled on the float, which was jammed in between the two ropes. The hippopotamus sprang out of the water, gnashing its teeth, snorting furiously and lashing the water into foam. It then dived and swam under water towards the men, when instantly the slack line was tightened and twisted round a huge block not far distant from the bank. The animal came once more to the surface about ten yards in front of the hunters, snapping its jaws together and seeking to break the rope, when it received two harpoons in the side. Leaving the water, it reached dry ground, hauled itself up on the bank and boldly made for the hunters, who thrust into its body half a dozen spears, some of which entered the jaws. At the same time sand was thrown into its eyes, which did more harm than the spears, the shafts of which were crushed like reeds; the sand, however, conquered the beast, which turned back, shaking its head, into the river. During this onslaught on land two of the hunters had seized the cord attached to the harpoons which had been thrown before the attack, and the unfortunate animal was now held by three harpoons, one of the ropes having given way, after being bitten through by the furious animal while under water. Once more the monster appeared on land and made, without hesitating an instant, another furious attack, rushing with its mouth wide open on the hunters, one of whom sprang forward and thrust a spear into its head without any result, while another rushed up with a sword which made only a harmless slit in the hide. Once more sand was thrown in the animal's eyes, and once more it was so blinded that it was forced to retire into the water. Six times the courageous beast left the water, and made a determined attack on its pursuers, breaking several spears, while others were blunted against the rocks, and rebounded from off his hide. The contest lasted three hours, when the spectator killed the animal with a shot between the eyes.

The pigmy hippopotamus (*H. liberiensis*), of the west coast, is a veritable dwarf beside its gigantic cousin, measuring only 6 feet in length and 30 inches in height at the shoulder. In addition to its small size, it differs from the typical species by possessing only a single pair of incisor teeth between the lower tusks. The head is more convex or rounded on its upper surface than that of *H. amphibius*; the legs are longer and more slender in proportion, and the eyes do not project out of the head like those of the typical species. Another striking character is the relatively long tail, which is proportionately about twice as long as that of the larger species. The face of the pigmy species is also relatively smaller than that of the large species, this bringing the eyes nearer the middle line of the skull. From recent observations, it appears that the pigmy hippopotamus is not uncommon throughout Sierra Leone and Liberia; and that as a rule it frequents the densest patches of covert in the forest, rarely leaving such shelter, except at night-time to visit adjacent cultivated land for food. Rivers are in no degree essential to its comfort; swamps and marshes—especially where there are 2 or 3 feet of soft mud beneath the surface—being far more in favour, provided that such spots are in dense bush, or have such covert within reach. When far from civilisation, these animals feed on roots, wild plums, and the leaves of various shrubs and trees. Their favourite foods are, however, cassava-root, gourds, and maize. These dwarf hippopotamuses appear to be solitary, and do not, as has been suggested, associate in pairs. At night, however, they undoubtedly meet their fellows at favourite spots, such as mud-holes. Nevertheless, although in some parts the bush is a perfect network of tunnels and runs made by these animals, it does not appear that any one such run is used by any other individual than its owner. It is, however, comparatively common to find the tracks of a cow with a well-grown calf at her heels; and it would seem quite likely that this may have given rise to the idea that the adults usually associate in pairs. In the day-time these hippopotamuses resort to the densest shelter, probably for repose; but in Sierra Leone and Liberia it is impossible for any man to follow the low, thorny and twisting tunnels through the bush without being detected long before reaching the animal's retreat.

This account is supplemented by the narrative of a German explorer who brought living specimens to Europe in 1912, and who observes that, unlike their big cousins, pigmy hippopotamuses do not frequent the rivers. On the contrary, they make their home deep in the inhospitable forest, in the dense vegetation, on the banks of the small forest-streams; but, not satisfied with the protection the forest affords them, they enlarge the hollows which the water has washed out under the banks, and in these tunnels, where they are invisible from the bank, they sleep during the heat of the day.

Remains of fossil hippopotamuses—some large and some small—have been found over the greater part of southern and central Europe, inclusive of the British Isles, and in North Africa, Madagascar, India, and Burma. One of the Indian species, which is the oldest, as well as that from North Africa, differs from the living species in having three pairs of incisor teeth in both jaws; but the one found in Europe seems inseparable from the modern larger African species. Of smaller size are species from the caves and fissures of Sicily, Malta, and other Mediterranean isles. Among these, one from the limestone caves of Cyprus was of even smaller size than the one from the Maltese bone-fissures, and only about half the dimensions of the common African species. This Cyprian species, the *H. minutus* of Cuvier, apparently displays affinities on the one hand with the living pigmy hippopotamus of West Africa, and on the other with an extinct Italian representative of the group. The occurrence in Cyprus of this dwarf fossil hippopotamus is considered to confirm the theory that many of the later Tertiary mammals of the Mediterranean islands were slightly modified survivors of species which disappeared at an earlier date from the adjacent mainland.



BLACK RHINOCEROS.

Black Rhinoceros. With the black rhinoceros (*Rhinoceros bicornis*) we take leave of the even-toed ungulates, in which the toes are either two or four in number and arranged symmetrically to a line dividing the middle pair, and reach the odd-toed group, in which the number is reduced to three in at least the hind-feet or even to one, which, like the middle toe of the triple type, is symmetrical in itself. The tapir group (*Tapiridæ*), in which there are four front-toes, is absent from Africa, in which, however, the other two families (*Rhinocerotidæ* and *Equidæ*) are well represented. Although the African rhinoceroses are here included in the same genus as their Asiatic cousins, it should be clearly understood that they differ considerably from them. The two African species lack, for instance, the heavy folds in the skin characteristic of their Asiatic relatives, and have likewise no front teeth in their jaws, whereas the Asiatic rhinoceroses are well furnished in this respect. Both kinds carry two horns, of which the front one may attain enormous dimensions.

The range of the black species now extends from Zululand and perhaps Ovampoland through Central and East Africa to Somaliland and Abyssinia; rather more than half a century ago it included Cape Colony. On the western side of the continent the animal is unknown north of Angola. This rhinoceros is easily recognised by its pointed and somewhat prehensile upper lip; while it is also distinguished from its larger relative by the structure of its cheek-teeth, the shape of its horns, and its mode of life. The relative proportions of the horns of both sexes, when well developed, are subject to great variation, the front horn being in some cases much longer than the other, while in others the two are nearly equal, and more rarely the second is the longer. These phases are distinguished by the natives, who employ the name borelli for individuals in which the second horn is the shorter, while the others are termed keitloa. Old bulls attain a shoulder-height of 5 feet and a length of over 10 feet, but females are rather smaller. Of the two horns, the one in front is generally curved backwards and circular in section, but the hind one is usually straight, with a sharper edge than the one in front. The East African *R. b. holmwoodi* is characterised by the length and slenderness of the front horn. This rhinoceros rarely, if ever, feeds on grass, but consumes roots, leaves, and branches, and consequently frequents forests in rocky regions where there is abundant brushwood. Although as many as seven have been seen together, as a rule they go about singly or in pairs or parties of three. When a female and calf are in company, the latter always walks behind its mother, while the calves of the other species go in front. Both species are nocturnal, although in cloudy weather they may occasionally be seen abroad in daylight.

It has long been known that many of the ruminants inhabiting the Kalahari Desert of southern Africa pass protracted periods during the dry season without ever drinking, although it seems that all of them are in the habit of eating bulbous roots, gourds, or other vegetable products containing a more or less copious supply of moisture. Recently evidence has been adduced to show that a similar habit characterises certain animals in Somaliland, among these being the black rhinoceros, which is generally supposed to stand in need of a daily drink.

These Somali rhinoceroses inhabit an arid range of gypsum mountains known as the Bur Dab; and there appear to be only two spots where they can obtain water, these pools being respectively about 33 and 45 miles distant from the ordinary haunts of the animals. According to native reports, confirmed to some extent by the experience of sportsmen, the rhinoceroses journey to these watering-places only very occasionally during the dry season, probably not more than once each during the whole protracted period. Important corroborative evidence is afforded by the case of a female rhinoceros and her young calf which inhabited a spot distant about five-and-twenty miles away from the nearest available water and were under observation for about six weeks. In this case the animals were seen in company at short intervals throughout that period; and it appears sufficiently evident that the calf would have been quite unable to accompany the mother on long and rapid journeys, while, on the other hand, the dam would not have been likely to leave her helpless offspring to the mercy of beasts of prey while she herself travelled fifty miles to drink.

On the other hand, there is a good substitute for water on the Bur Dab in the shape of a succulent kind of aloe known to the Somalis as *dur*, which grows abundantly in the district frequented by rhinoceroses. That they eat the thick juicy leaves of this aloe is proved by their stomachs containing dur-fibre, bitten into pieces about an inch and a half in length by half an inch wide.

The ability of the black rhinoceros to go for weeks at a time without drinking is thus fully explained; and from other evidence it is apparent that many kinds of ungulate mammals, both in south-western and north-eastern Africa, have accustomed themselves to exist for a considerable portion of the year either without drinking at all or to be content with an occasional visit to water; obtaining such moisture as they require by feeding on the leaves, fruits, or tubers of luscious plants.

The Somali rhinoceros forms a distinct local race of the species (*R. b. somaliensis*), characterised, among other features, by its small size and long and narrow skull, as well as by the peculiar structure of the skin.

White Rhinoceros. The second African representative of the group is the white rhinoceros (*R. simus*), the largest of land mammals next to the living elephants. Although now almost, if not quite, exterminated in the southern and typical part of its habitat, to which it was long supposed to be restricted, the species survives in the district of Lado, which lies five degrees to the north of the equator, where it is represented by a local race known as *R. s. cottoni*. From the habitat of the typical white rhinoceros, which is situated between the Orange and Zambesi Rivers, Mashonaland being the headquarters, the tract inhabited by the northern race is separated by some 15° of latitude.

The white rhinoceros was discovered in 1812 by Burchell in the great tract of open grass-land lying between the Orange and Zambesi Rivers, to which area it appears to have been restricted during the last century. There is, however, a native tradition that in earlier days it also inhabited the grassy plains of Bushmanland, to the south of the Orange River; this being confirmed by a statement made in 1797 by Sir John Barrow to the effect that in his time a distinct variety of the ordinary African rhinoceros was to be met with in the district in question. But previous to the discovery of the Lado race there was no evidence of the occurrence of a white rhinoceros anywhere north of the Zambesi; and even now we have no testimony as to its existence between that river and the north-eastern corner of the Victoria Nyanza. The numbers in which these huge animals were met with by Andrew Smith, Cornwallis Harris, Gordon Cumming, Andersson, Oswell, and Vardon, and the ruthless way in which they were shot down by these sportsmen are now matters of history.

The slaughter, indeed, was carried on with such vigour that some years ago it was supposed that the sole survivors of the species were a few in a corner of north-east Mashonaland, from among which were procured the specimens now in the British Museum and the Museum at Tring. In 1894 naturalists were, however, delighted to hear that a few of these huge pachyderms still lingered in the tsetse-haunted jungles of Zululand between the Black and the White Umvolosi Rivers; but there is considerable doubt whether, in spite of legislative protection, it will be possible to preserve the race in this area; and the existence of a representative of the species in the north is a source of satisfaction to all who view with regret the disappearance of the great beasts of the earth. The skull of the white rhinoceros differs in several structural details from that of its black cousin. The most important of these differences is displayed by the cheek-teeth, which have much taller and more complicated crowns than those of the other species. Moreover, in the black rhinoceros the teeth are worn into alternate ridges and hollows, but in the white species they wear into a uniformly flat plane. Evidently this difference is connected with the food of the two animals; and it is now known that while the black species browses on twigs and leaves, its white cousin subsists solely by grazing. Consequently, it is only on open grassy plains that the latter magnificent animal is to be met with. Why it was called by the Boers the white rhinoceros (*whit rhinaster*) is a matter difficult to understand.

Reasons have recently been given by a French naturalist for regarding the white rhinoceros of the Lado Enclave and the Bahr-el-Ghazal as the original of the unicorn, or licorn, of the ancients. In 1848 M. Fresnel, then French Consul at Jedda, addressed a letter to the Paris Academy relative to the existence in the southern Sudan of a single-horned rhinoceros. This rhinoceros was known to the Arabs under the name of abou-karu (the possessor of one horn), as distinct from the black rhinoceros, which they call khertit. The abou-karu was stated by Fresnel to inhabit the south of Wadai, the region to the south-west of Darfur, and to the east of Lake Chad, which is the habitat of *R. s. cottoni*. The Arabs in Fresnel's time had not, however, apparently seen the animal in the flesh, but were acquainted with it merely by the long front horns, which were carried north as articles of commerce. Going back still earlier, we find Diodorus Siculus, a contemporary of Julius Cæsar, alluding to a rhinoceros from Ethiopia which carried on the tip of its nose a single flattened horn, almost as hard as iron. This description accords with the one given by the Arabs of Hedjaz to Fresnel in 1848, and indicates the same animal. In this connection it is important to bear in mind that in ancient times, and even during the Middle Ages, the horn of the unicorn was believed to serve as a defence against poison, and was for that purpose carved into cups. When a poisonous draught was poured into such a cup the liquor was supposed to effervesce, as is still believed to be the case in China, where rhinoceros-horn cups are used. This puts the oryx and the narwhal out of court as claimants to being the true unicorn, for one might as well try to drink out of a sword-scabbard as from an oryx-horn or a hollowed-out narwhal tusk. The rhinoceros-horn cups used by the Chinese as poison-detectors are generally carved and mounted on metal stands. Although it cannot be affirmed that the case is proved, yet the foregoing arguments in favour of regarding the Lado white rhinoceros as the unicorn of the ancients seem difficult to refute. The history of white rhinoceroses does not, however, end here. So far back as the year 1688 the teeth of an animal, then supposed to be a marine monster, were discovered in the superficial deposits of Chartham, near Canterbury; and subsequently these and other similar remains were ascertained to have belonged to an extinct species of rhinoceros, for which the name *R. antiquitatis* was proposed in 1803. From the discovery of entire carcases embedded in the frozen soil of Siberia, it was further ascertained that this woolly rhinoceros, as it came to be called, was furnished with a coat of thick hair in order to protect it from the intense cold of the period in which it flourished. And it was eventually found that the range of this species included the greater part of Europe and northern Asia. Later on this extinct European and Asiatic species was found to be closely allied to the living white rhinoceros of South and Central Africa.

The latter is easily recognised by its very wide and blunt nose, from the extreme edge of which grows the long front horn, which has a broad squared base and a flattened front surface. In females the front horn, which is larger and more slender than in the bulls, may curve forwards in such a manner that its tip touches the ground when the animal is feeding, and is consequently worn into an oblique facet.

In height, old bulls of the white rhinoceros are stated to measure over 6 feet in height at the shoulder, and, exclusive of the tail, to exceed 13 feet in length.

In the Lado Enclave, on account, apparently, of their poor eyesight and generally sluggish disposition, white rhinoceroses can easily be approached to within a distance of 20 feet, and may then be watched for as long as desired. Every night they go either to the Nile or to a pool to drink, and after quenching their thirst travel back to the dry country, stopping from time to time to graze as opportunity occurs. About 9 a.m. they lie down to rest, usually in the scanty shade of a thorn-tree, where they remain till well on in the afternoon, when they resume grazing, and continue feeding until sundown. As a rule, the males are found alone, and the females accompanied only by their calves; but occasionally three or four may be seen in company. Their tracks are easy to follow; and when the animals are overtaken they appear less excitable and less bad-tempered than the black species, although they will occasionally charge. All this agrees with the accounts given of the habits of the southern race of the species in former days; and it especially emphasises—now that Lado has come under British rule—the need of protecting these animals from undue slaughter.

There has long been a belief that the horns of rhinoceroses are movable; James Greenwood, for example, wrote in 1862 as follows:—

"Concerning the horns of the rhinoceros, there exist many curious superstitions, one being that when the animal is undisturbed by man and at peace with his fellows, its foremost horn is plastic as the trunk of the elephant, and put to the same purposes; but that when enraged the accommodating implement stiffens to a weapon of war, and relaxes not till the ire of the terrible beast cools. This doctrine, however, may be not without foundation, for, as has already been stated, the horn is merely seated on the top of the nose, having for its base a peculiar knob of bone. . . . The root of the horn may be planted in a bed of muscle, which, when the animal is at rest, may so far relax as to admit of the weapon swaying slightly, giving it, to the eyes of the furtively watching savage, an elastic appearance."

Again, the African traveller William Burchell observes that the horn of the rhinoceros "grows from the skin only, in the same manner as the hair—a circumstance which entirely divests of improbability the assertion of its sometimes being seen loose, although by no means so loose as some writers have supposed. Nor is it at all extraordinary that the rhinoceros should possess the power of moving it to a certain degree, since the hog, to which, in the natural arrangement, it so closely approaches, has a much greater power of moving its bristles, which if concreted would form a horn of the same nature."

MASAI ASSES.

Observations recently made in the London Zoological Gardens show that the idea of rhinoceros horns being mobile is based on fact, although the degree of mobility is very slight. It is, however, no doubt sufficient to have given rise to the legends referred to above.

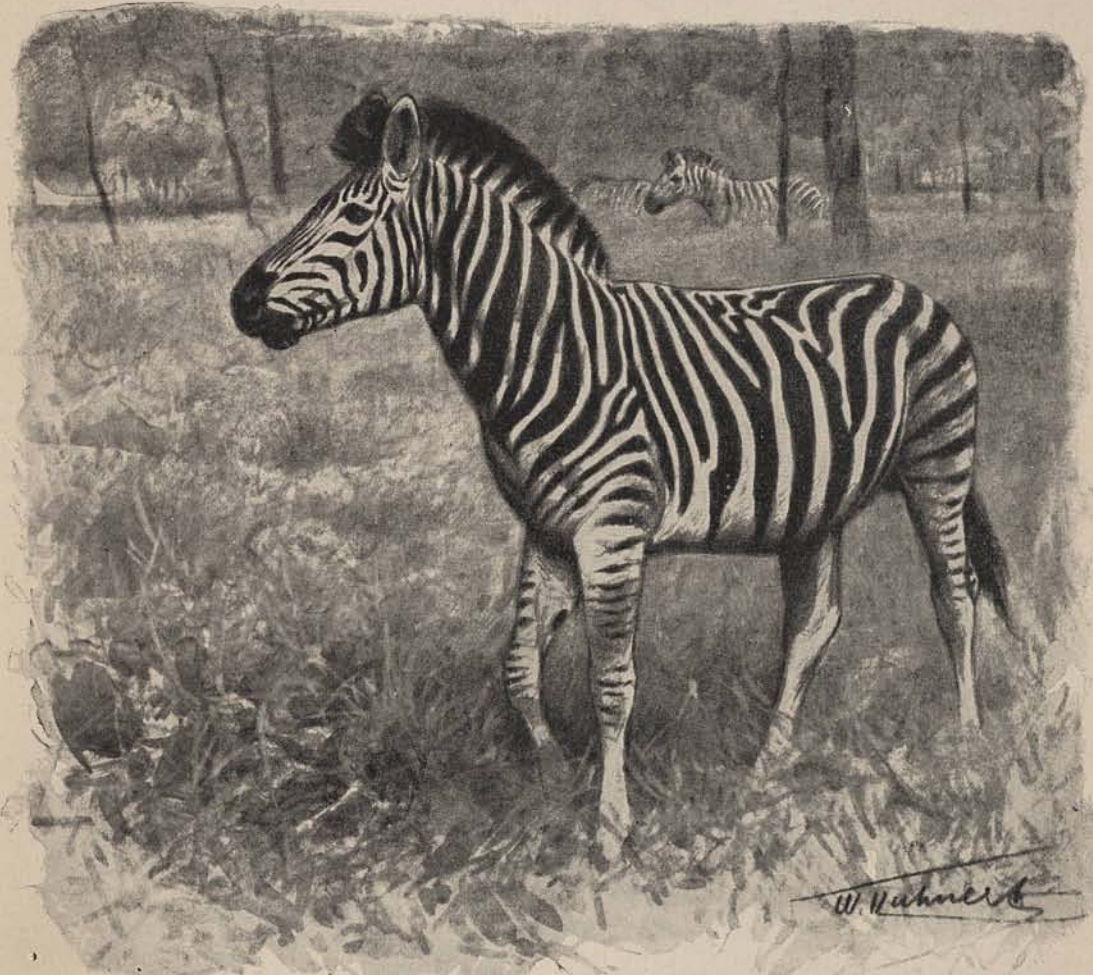
Wild Ass.

Ethiopian Africa is the home of numerous representatives of the horse family (*Equidæ*), all of which differ more or less markedly from the horse itself, which is now a native of Asia but in former days ranged all over Europe in the wild state. On the other hand, the ass (*Equus asinus*) is essentially an African species, and is represented by three wild races in the north-eastern districts of the continent. From the so-called wild asses of Asia, which are more nearly akin to the horse, the African wild asses, in common with their domesticated descendants, differ by their much larger ears, and the approximate equality in size of the fore and hind hoofs. Of the three wild races, the one inhabiting the northern coast of Somaliland, and scientifically known as *E. a. somaliensis*, is of a mouse-grey colour, white below, with a darker head, and also white on the muzzle and the inner sides of the legs, which are marked with transverse dark bars. The Abyssinian *E. a. tæniopus* combines with these leg-bars well-developed dorsal and shoulder stripes; while the Nubian *E. a. africanus* is distinguished by a dark shoulder-stripe, which is either totally absent or but very indistinctly visible in the Somali race, and also by a blackish stripe along the back. In colour it is clear French grey in summer, with the muzzle, under-parts, and both sides of the lower portion of the legs white, and, at most, but very faintly barred. In spite of the scanty food afforded by their desert-home, these fine animals, which stand about 4 feet at the shoulder, are always in the pink of condition, and are possessed of such speed that the Arabs, on their fleetest dromedaries, are unable to run down the foals. Domesticated asses differ from all the foregoing wild races by the legs being coloured like the body, instead of being much lighter, as well as by the ear having a dark patch at the base, and a black tip.

Zebras and Quaggas.

Quite peculiar to Africa are the striped equines known as zebras and quaggas, of which there are several distinct species. Of these the typical, or mountain, zebra (*E. zebra*) is the one coming nearest to the wild ass, with which it agrees in its relatively large ears and general shape. The most easily recognised characters of this animal are the gridiron-like pattern formed by the stripes on the rump immediately above the root of the tail, and the circumstance that the transverse body-stripes are not continued across the under surface to join the longitudinal ventral stripe. The legs are striped right down to the hoofs, and there are no paler stripes on the white intervals between the body-stripes. The zebra, which stands about 48 inches at the shoulder, is essentially a mountain animal, and displays marvellous activity in getting over rough and precipitous ground. Formerly found on all the mountain-ranges of Cape Colony, it is now restricted in this part of Africa to the Cradock district, where it is under government protection; but it is represented by a local race in the mountains of German East Africa. To the Boers the zebra is known as the *wilde-paard*, and gives its name to Paardeberg.

A second group is formed by the now extinct quagga (*E. quagga*) of South Africa, and the widely spread and variable bonte-quagga, or Burchell's zebra (*E. burchelli*), which are closely connected. In neither of these species is there a large and distinct gridiron-pattern on the rump, while in the more northern and fully striped races of the latter the body-stripes usually extend right round the body to join the ventral stripe, and the ears are smaller than in the zebra. The legs may be either white or striped to the hoofs, and pale "shadow-stripes" are frequently developed between the dark body-stripes. The quagga, in which the striping is restricted to the head, neck, and fore-quarters, formerly abounded on the plains to the south of the Vaal River and west of the Kei, its range including the Orange River Colony and the southern and central districts of Cape Colony. "Skin-hunting" resulted, however, in the total extermination of this interesting animal, which seems to have disappeared for ever during the sixties of last century. It has been supposed that there were several races of quagga, for two of which were suggested the names *E. q. greyi* and *E. q. lorenzi*; the former name being in honour of the late Sir George Grey, the donor of one of the last survivors of the species to the London Zoological Gardens.



BOEHM'S BONTE-QUAGGA.

Later on, a third was added to the number of these presumed races, while it was at the same time pointed out that a quagga in the Museum at Paris appeared to be in many respects between *greyi* and *lorenzi*. To this Paris specimen, together with another in the museum at Turin, a Spanish naturalist has given the name *E. trouessarti*. The evidence of the Paris and Turin specimens would, however, seem to be in favour of regarding *greyi* and *lorenzi* as inseparable; and perhaps it is too late in the day to attempt the determination of local races of the species.

The typical South African race of the widely ranging bonte-quagga (*E. burchelli typicus*) comes so close to the quagga that the two have been regarded as specifically inseparable. Be this as it may, the typical bonte-quagga is a rather larger animal with white legs, the stripes extending well on to the hind-quarters, and the orange ground between the broad, dark brown body-stripes marked by the aforesaid faint shadow-stripes. This typical race is now verging on extinction, if indeed it has not already ceased to exist, but the species is represented by a number of local races in Central and East Africa, in which the legs are more or less fully striped, while the shadow-stripes gradually disappear till, in the northern races, they are completely wanting. The species presents, in fact, a curious analogy to the local colour-variations in the giraffe. There is, however, this remarkable difference in the two species, namely, that while in the bonte-quagga white legs are distinctive of the southern races, precisely the reverse of this occurs in the case of the giraffe.

Griqualand West and the Orange River Colony were the habitat of the typical race of the species. Between the watersheds of the Limpopo and the Zambesi occurs the race known as *E. b. chapmani*, a slender-built and short-limbed animal, with the legs barred to the hoofs, but the shadow-stripes still distinct. Between the Orange River and the watershed of the Cunene and Coanza Rivers is found the Damara race (*E. b. antiquorum*), in which the legs are barred to the knees and hocks and the shadow-stripes are distinct. The Mashonaland race is known as *E. b. selousi*, and the one from Nyasaland as *E. b. crawshayi*. With the East African *E. b. boehmi*, whose range includes the country between the Zambesi and the first parallel of north latitude, we come to a race in which the ground-colour of the coat is white (tinged with yellow in old age), the stripes are nearly black, and the legs fully barred, with the pasterns black. With the Lake Rudolf country and adjacent parts of Abyssinia, we reach the domain of the race differing the most widely of all from the typical southern animal, so widely indeed that by some naturalists it has been regarded as a species by itself. This race, *E. b. granti*, in which the ground-colour is pure white and free from shadow-stripes, has the stripes deep black, and the legs barred right down to the hoofs, with wholly black pasterns. It should be added that the foregoing list does not include the whole of the races of this species, but those selected for mention suffice to show the extreme range of its local variation.

In the old days, bonte-quaggas swarmed on the open veldt of South Africa, where they generally associated in large troops, and consorted with gnus and ostriches. In parts of East Africa such large troops may still be seen, but from the south they have long since disappeared.

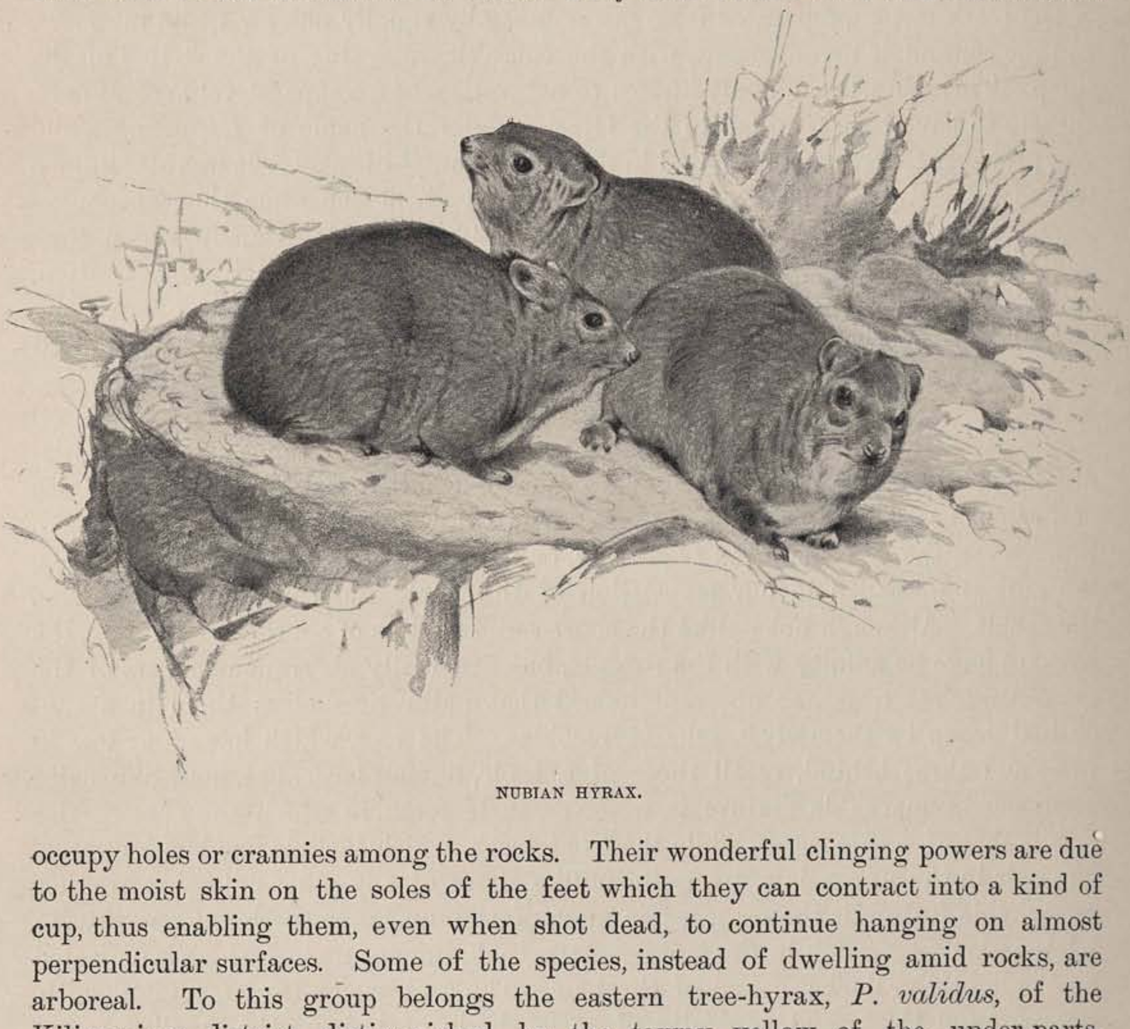
A zebra inhabiting the mountainous country opposite Teti, on the north bank of the lower portion of the Zambesi valley, has been described as a distinct species, under the name of *E. foai*. From all the races of the bonte-quagga this zebra appears to be distinguished by the larger number of main stripes on the body and hind-quarters, and by the circumstance that there is no backward bending, except in the last one, of the body-stripes as they approach the longitudinal back-stripe, to which they run nearly at right angles. In this respect Foa's zebra approximates to the true zebra and the undermentioned Grévy's zebra, from both of which it differs by the stripes on the hind-quarters nearest the dorsal stripe running parallel with the latter in the direction of the tail, as in the bonte-quagga, instead of at right angles. Consequently, the gridiron-pattern of the true zebra, and the concentric stripe-arrangement of Grévy's zebra in this region are wanting. In general build, as well as in the shape of the head and ears, Foa's zebra is nearer to the bonte-quagga than to either of the other two. This is indicated by the fact that the body-stripes meet the stripe traversing the middle line of the under surface. The legs are striped to the fetlocks, and the pasterns black, as in the northern bonte-quaggas.

Markedly different from all the foregoing is Grévy's zebra (*E. grevyi*), of Somaliland and Abyssinia, a large species recognisable at a glance by the huge, broad ears, thickly lined on the inside with long hair, the great number and narrowness of the black stripes, separated from one another by equally narrow white intervals, and the concentric arrangement, with the concavity upwards, of the stripes on the rump. This zebra, though only known to naturalists at a comparatively recent date, appears to have been familiar to the Greeks under the name of *Hippotigris*, and was probably the species exhibited in the Roman amphitheatre. It was also known to, and figured by, Job Ludolphus in 1681; and about the same time specimens were sent to the governor of the Dutch East Indies at Batavia, by whom they were presented to the Emperor of Japan. Possibly, in the matter of coloration, Grévy's zebra is the most primitive member of the whole group; the quagga, the typical race of the bonte-quagga, and the wild ass, being evidently specialised species, which have tended, in a greater or less degree, to discard the striping.

Hyraxes.

Ethiopian Africa, from between the Cape and 20° N. latitude on the east and west coasts, as well as in many of the central equatorial districts, is the home of a remarkable group of small ungulates of about the size of a rabbit or a hare, known as hyraxes. The typical representative of the group is, however, the Syrian hyrax (*Procavia*, or *Hyrax*, *syriaca*) of Syria and Arabia, the animal miscalled in our translation of the Bible the coney, that is to say, the rabbit. Although not unlike the short-eared rabbits of south-eastern Asia, the hyraxes have no affinity with the rodents, but are really aberrant members of the great Ungulate order, so aberrant indeed that naturalists class them in a subordinal group by themselves—the Hyracoidea. The feet, which have four toes in front and three behind, recall those of a tapir, having large, flat, hoof-like nails. Their most remarkable feature is, however, their teeth, in which the cheek-series recalls that of a rhinoceros, while the front teeth, which include one large, dagger-like pair in the upper jaw, are quite unlike those of any other animal. Another remarkable feature is the presence, in most of the numerous species at any rate, of a large glandular patch in the middle of the back, the position of which is indicated by the lighter or darker colour of the hair. The coat, which is of medium length, is coarse and thick, and generally of some shade of brown; the small ears are rounded and half-buried in the fur, and the tail is rudimentary.

The more typical species of hyrax generally inhabit rocky districts, ranging from sea-level to an altitude of as much as 10,000 feet. In Nubia the group is represented by *P. burtoni*, while Abyssinia is the home of *P. abyssinica*, a species characterised by the small and inconspicuous gland-patch on the back. A third species, *P. shoana*, inhabits Shoa and southern Abyssinia, and is almost the largest of the group with the exception of the Cape hyrax; it is distinguished from most other species by the patch, marking the gland on the back, being black, and also by its long, soft, silky coat. A fourth species, Bruce's hyrax (*P. brucei*), which ranges from the south of Abyssinia, through Somaliland, into Portuguese East Africa and Nyasaland, is small, with a long, narrow, yellow or whitish patch on the back; it lives at an altitude of about 1500 feet. The Cape hyrax (*P. capensis*), ranging from the extreme south of Cape Colony into Rhodesia, has moderately long, soft, fine, greyish brown fur, flecked with pale yellow or white, and the gland on the back marked by an irregular oval black patch. These hyraxes lead much the same kind of life as marmots, feeding in the morning and evening, and coming out of their holes to sun themselves at noon. They do not make their own burrows, but occupy holes or crannies among the rocks. Their wonderful clinging powers are due to the moist skin on the soles of the feet which they can contract into a kind of cup, thus enabling them, even when shot dead, to continue hanging on almost perpendicular surfaces. Some of the species, instead of dwelling amid rocks, are arboreal. To this group belongs the eastern tree-hyrax, *P. validus*, of the Kilimanjaro district, distinguished by the tawny yellow of the under-parts. Dwelling in the dense forests of Kilimanjaro at a height of from 7000 to 10,000 feet, it spends its time in the branches of trees, where it both sleeps and breeds. Another member of the same group, the western tree-hyrax (*P. dorsalis*), ranges from Liberia to the Cameruns, and is distinguished by its rather large head, and the long, shaggy black fur, in which the hairs are white at the tips. The South



NUBIAN HYRAX.

African tree-hyrax (*P. arborea*), a native of eastern Africa south of the Zambesi, has a shorter head than the others, and is dark grey in colour, with the hairs blackish brown at their bases. Numerous other species have been described, one of which inhabits the Algerian Sahara.

Tree-hyraxes have the habit of hunching up their backs into the form of a high arch, which gives them a most peculiar appearance when at rest. As a rhinoceros-like foot is not very well adapted for holding on to smooth surfaces of rocks or the bark of trees, these animals have the power of elevating the centre of the sole so as to form a sucker, and are thereby enabled to clamber or climb about in either situation with facility.

As already mentioned in an earlier chapter, extinct generic types of hyraxes, some of the species of which were of large size, occur in the lower Tertiary formations of the Fayum district, thereby indicating that Africa was the birthplace of the group.

The "coney" was prohibited as food to the Hebrews of Biblical times. Whether the presence of the dorsal gland had anything to do with the prohibition of "coney"-meat as an article of diet, it is impossible now to say. The ostensible reason of the prohibition was that the "coney," like the hare, chewed the cud without "dividing the hoof." As a matter of fact, neither the hyrax nor the hare really chews the cud—a function which is strictly confined to ruminants. Nevertheless, the peculiar movements of the lower jaw and lips of both animals when feeding might readily convey the idea to non-scientific observers that they really ruminate.

Elephant.

Largest of living quadrupeds, the African elephant (*Elephas africanus*) is one of the two living representatives of the Proboscidean suborder of Ungulata; a group which, in past times, had a number of representatives and ranged over the greater part of the world, including Siberia and North and South America. The group has a most interesting past history. Originating in Egypt and the neighbouring districts, it was represented in the earlier strata of the Tertiary period by a primitive species of the size of a tapir, which lacked a trunk and most of the features which we commonly regard as characteristic of elephants, but which was, nevertheless, unmistakably an ancestral elephant. From this ancestor, through an intermediate form, was developed the earliest mastodon, a small, primitive elephant with tusks in each jaw, and a long, trough-like lower jaw and lips to support the elongated and trunk-like muzzle. From Africa these mastodons migrated into Asia, where the true elephants appear to have been developed, and whence the immediate progenitor of the existing African species returned to the land of its earliest ancestors.

From its Asiatic cousin (*E. maximus*) the African elephant is distinguishable at a glance by several external features, notably the much larger size of the ears, which in some of the numerous local races completely cover the shoulders, and when the animals are excited stand erect so as to produce a most remarkable appearance. When in repose they lie flat on the neck and shoulders. The trunk, too, is of a different type of structure, looking as though made in segments of different calibre, instead of forming an evenly tapering smooth tube. Then, again, the tip of the trunk has a finger-like process on both its upper and lower margins whereas the Indian species is provided with only one such finger. In addition to these peculiarities, the African elephant has the forehead more vaulted than in its Asiatic relative, and the eyes larger. As a rule, the African species has tusks in both sexes, and those of the males of some races attain dimensions vastly exceeding those of the other species. The general colour of the skin is darker than in the Indian elephant; and while the hind-feet of the latter are furnished with four nails, those of the African species carry but three. The African animal also stands higher at the shoulder, and is more hollowed in the back. Lastly, the molars, or cheek-teeth, of the African elephant, are of a totally different type from those of the Asiatic species; to describe them in this work would be out of place, and it must suffice to mention that, compared with those of the Asiatic elephant, they have fewer, lower, and thicker transverse plates, the worn surfaces of which are lozenge-shaped instead of being narrow ellipses. In a word, the African elephant, as regards the structure of its cheek-teeth, makes one step from the Asiatic species in the direction of the aforesaid mastodons, with which it is closely connected by extinct Indian species.

In regard to the size of the tusks, it may be mentioned that specimens exceeding 11 feet in length along the outer curve are known, although these are not by any means the heaviest on record. Of a remarkably fine pair imported from Zanzibar some years ago, one measured 10 feet 4 inches in length and weighed 235 lbs., while the weight of the other was 10 lbs. less. In stature the species may reach between 11 and 12 feet.

Athough occurring in past epochs in Algeria and Spain, the African elephant is now restricted to the region south of the Sahara, Timbuktu and Abyssinia being the northern limits of its range on the two sides of the continent. South of the karu elephants still survive in Cape Colony in the forest situated between Mossel Bay and Grahamstown, as well as in the Addo Bush, where they are specially protected; in Zululand there are a few herds round St. Lucia Bay; some remain in the Transvaal north of Pietermaritzburg, as well as in Gazaland, and between Beira and the Zambesi they begin to be numerous, while northward of that locality there are several districts where they are abundant. On the west coast a few are to be found as far south as Ovampoland.

Of the numerous local races into which the species has been divided it will suffice to mention a few of the more noteworthy. Among these, the Addo Bush race (*Elephas africanus capensis*) is characterised by the squared form of the ears, which are not very large. In marked contrast to this are the rounded ears of the south Cameruns race (*E. a. cyclotis*), which are likewise of comparatively moderate size, and appear to be peculiar in not having the upper margin bent over to the inner side. Proportionately the smallest ears are those of the Masai race (*E. a. knochenhaueri*) of German East Africa and probably north-eastern Rhodesia, in which these organs are nearly triangular in shape, with the upper border deeply reflected. These elephants attain huge dimensions, but in Rhodesia, at any rate, have relatively small tusks. In the Abyssinian or eastern Sudan race (*E. a. oxyotis*) the ears attain enormous dimensions, measuring over 6 feet in vertical diameter. In shape they form an elongated triangle with the upper margin rounded and the lower angle narrow and pointed. The bulls of this race—which is to be met with on the

AFRICAN ELEPHANT.

Blue Nile—attain an enormous stature, but do not carry tusks at all approaching in size and weight those from the equatorial regions. Smallest of all is the dwarf Congo elephant (*E. a. pumilio*), which does not appear to exceed 7 or 8 feet in height. Whether this race is the so-called water-elephant of the great lakes of the Congo district, or whether that mysterious animal represents an altogether distinct type, is a question which cannot yet be decided.

Indian and African elephants, it may be mentioned, have quite different ways of using the tips of their trunks. In the former, some small object, such as a handful of bran, is held by the tip of the trunk being bent on itself, so that the object is squeezed between the tip and the lower surface of the trunk, whereas in the latter the object is held between the two lips of the trunk-tip, much after the fashion in which fruit is placed in a cornucopia.

In habits the different local races appear to present certain diversities from one another; the East Sudan race digging to a great extent in the sand for roots, and consequently wearing away the extremity of one tusk, generally the right. In the more central races this habit is apparently less marked, but it reappears in South Africa, where whole tracts may be seen ploughed up by the tusks of these animals. Speaking generally, African elephants appear to be stronger and more active animals than their Asiatic relatives, their movements being quicker, and the activity they display when ascending steep places being little short of marvellous. On Kilimanjaro they ascend to a height of about 10,000 feet, and in Abyssinia to between 6000 and 7000 feet. In this respect they resemble the Indian species, which in Ceylon ascends to 7000 feet, and in British Bhutan to the summit of Sáthi-La, which is 10,350 feet above sea-level. This they do at all seasons of the year, according to the observations of a member of the Indian Forest Service, who states that in April 1907, when snow lay so late that yaks were grazing in Sikhim at 7000 feet up to the second week in May, he found on visiting Sáthi-La that the snow—then about 2 feet deep—had been trampled down by them in all directions, all sizes of elephants being represented down to very young calves. While there they feed on the maling bamboo (*Arundinaria racemosa*) and bathe in the small ponds, of which there are three near the top of the hill. Whether this even is the greatest elevation to which they ascend cannot be determined, although it is possible that they go even higher in Bhutan if there is suitable ground.

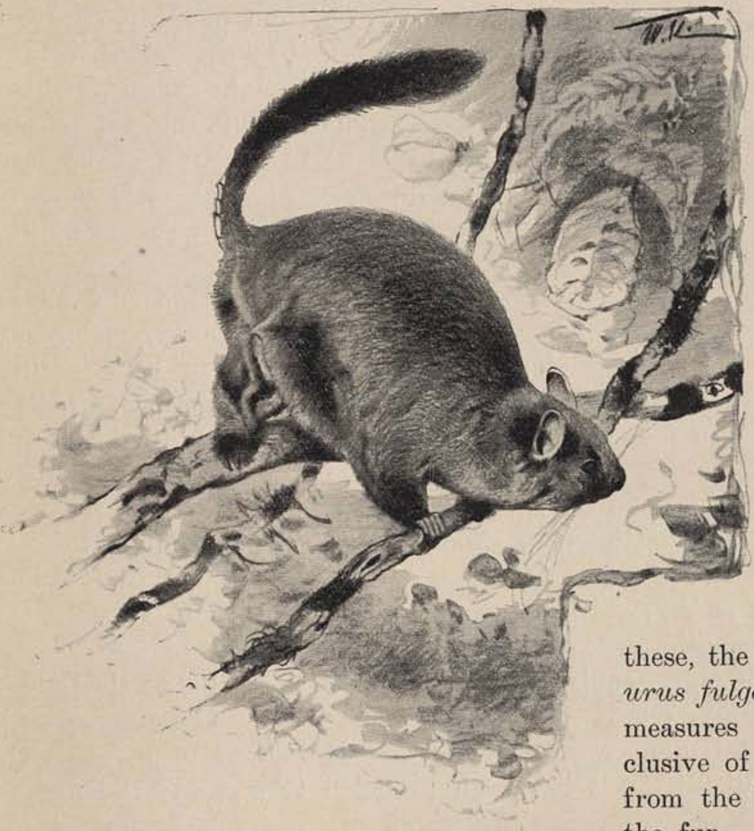
On the other hand, the African elephant presents a marked contrast to its cousin in India in that it frequents the burning plains of the Sudan, covered with parched grass, far away from the forests, and this too in the midst of the noon-tide heat. In accordance with the structure of its teeth, the African species feeds on coarser food than the Asiatic elephant; its diet in South Africa comprising roots, both fibrous and bulbous, and fruits, either plucked from the trees or picked up from the ground. As a rule, it is a careful feeder, doing little harm to the trunks or the branches of the trees, and selecting, in preference, such kinds as yield gum or resin. Occasionally, however, it destroys trees, breaking off their stems a foot or so from the ground in order to obtain the tender foliage and shoots of their tops; but, in general, it does little damage to the forests. In South Africa elephants occasionally eat grasses with large seeds, and in this respect differ from those in the Sudan, which feed chiefly on branches and roots, and do much harm to the mimosas.

Elephants feed and travel at night and in the early morning, passing most of the day in sleep, when, where possible, they take their stand in the shade of trees. While they sleep, their bodies sway from side to side, and their tails and ears are in motion to drive away flies and other insects. In hot weather they drink nightly, but in the cool season not infrequently go for two or three nights without water. Their powers of vision are anything but good, as they seem unable to distinguish a man from a tree at over fifty yards, and their hearing is not very keen; these deficiencies being amply compensated by the extraordinary delicacy of their sense of smell. They can consequently be approached only up-wind, the scent of the smallest infant being sufficient to put an entire herd to flight.

As a rule, elephants associate in small parties, which comprise the members of a single family, in the shape of females, young males, and calves. The old bulls are either solitary or go about in twos or threes, although they rejoin their fellows when the herds migrate in search of food. On such occasions each herd may include from ten to a hundred or more head.

The African elephant affords at the present day the main supply of ivory, the amount received from India being comparatively small. The natural inference would be that as the numbers of their species are reduced, the price of ivory would continue to appreciate in a regularly increasing ratio. As a matter of fact this is not the case, as is illustrated by the following summary of the fluctuation in the prices of various kinds of African and Indian ivory between 1870 and 1910. A set of charts published by a London firm of ivory-brokers shows, for example, an alternating series of maxima and minima in prices, although in some cases there is a variation of a year or two in the maxima of the different descriptions, and the oscillations, as might have been expected, are greatest in the case of "billiard-ball pieces," the most valuable of all. In 1870 ivory of every description was cheap, "hard Egyptian," the least valuable of all, selling at £29 per cwt., while West African realised £35, "soft Indian" £40, and billiard-ball pieces £50. In some instances there was a fall during the next two years, when hard Egyptian touched £25; but between 1873 and 1875 occurred the first of three marked maxima, when hard Egyptian reached £50, West African £66, and soft Indian £68 per cwt. The rise did not affect billiard-ball pieces till 1881, in which year the price mounted to £90. The closure of the Egyptian Sudan during the second half of the eighties resulted in a second and still more marked maximum in 1889 in some descriptions, and in 1890 in others. Hard Egyptian, for instance, touched £50, West African £68, soft Indian £82 (in a few sales £88), and billiard-ball pieces £105, or occasionally rather more. After 1890 there occurred a big fall, lasting (except in the case of billiard-ball pieces, which had a rise in 1895 nearly equal to that of 1890), with a minor rise in 1899 or 1900, till the close of 1906, when there occurred the third and biggest maximum of all. During the fall in the nineties, which culminated in 1895 and 1896, prices sank nearly to, or even below, the 1870 level. In the great ivory-famine lasting from the end of 1906 to the early part of 1908—the reason for which is not very apparent—hard Egyptian touched £60, West African £80, soft Indian £86, while billiard-ball pieces generally sold at from £155 to £160, and even touched the enormous price of £180 per cwt. for what are known in the trade as "ball-centres." Since the early part of 1908 there has been a marked decrease in the price of ivory of all descriptions, the four kinds above mentioned standing at the close of 1910 respectively at £47, £62, £67, and £102 per cwt.

Scaly-Taile Squirrels. Leaving the hoofed mammals and turning to the rodents, the first group for consideration is the small but remarkable family commonly known as scaly-tailed squirrels, but better designated simply scaly-tails, since they have nothing to do with the true squirrels. This family is restricted to equatorial Africa, where it is most numerously represented on the west coast. All these *Anomaluridæ* are characterised by the presence of a number of scales on the under surface of the tail, which aid in climbing. The most generalised member of the family is the flightless scaly-tail (*Zenkerella insignis*), of the west coast, a small, grey, squirrel-like animal without a flying-membrane. Such a membrane, which differs somewhat in structure from that of the flying-squirrels, is developed, however, in the other species, all but one of which belong to the typical genus. Of these, the red scaly-tail (*Anomalurus fulgens*) of the Gabun, which measures about 21 inches, inclusive of the tail, takes its name from the bright orange colour of the fur.



FRASER'S SCALY-TAIL.

The pigmy scaly-tail (*A. pusillus*) of Equatoria is a much smaller species, dark grizzled grey above and yellowish white beneath; a third kind, Fraser's scaly-tail (*A. fraseri*), is a dark-coloured West African species, ranging from the Gabun to the Congo, while a fourth is *A. erythronotus* of the Congo, distinguished by the black muzzle, a black ring round each eye, and a large black spot behind each ear. The same features characterise *A. jacksoni* of Uganda, in which, however, the general colour is dusky grey; while *A. cinereus* of Nyasaland is also dusky grey, but without the black markings, and with a white band between the ears (as in *A. fulgens*).

Most remarkable and conspicuous of all is the black-and-white scaly-tail

(*A. peli*), from the Gold Coast, in which the upper parts are black, with the lateral and posterior margins of the hind half of the flying membrane, the soles of the hind feet, and the whole of the bushy tail white; the under surface of the body being whitish grey. The entire length is about 36 inches, of which 18 are taken up by the tail, inclusive of the terminal hair. In its colouring this species recalls the black-and-white Guereza monkeys; and probably, like the latter, frequents trees clothed with long, pendent white lichens. Also from West Africa is the still more remarkable long-tailed scaly-tail (*Idiurus zenkeri*), a mouse-like species alone representing a genus characterised, among other features, by the great length of the tail, of which only the tip is bushy.

Squirrels. Exclusively Ethiopian is the group of ground, or spiny, squirrels, members of the family *Sciuridæ*, characterised by their harsh, bristly fur, the small size or absence of ears, and the comparatively slight curvature of the claws. One of the numerous species is the Abyssinian spiny squirrel (*Xerus rutilus*), which lives either in the clefts of rocks or in burrows of its own construction. Of the approximate size of an ordinary squirrel, it is uniform yellowish red in colour, with barely visible ears, and associates in parties of five or six.

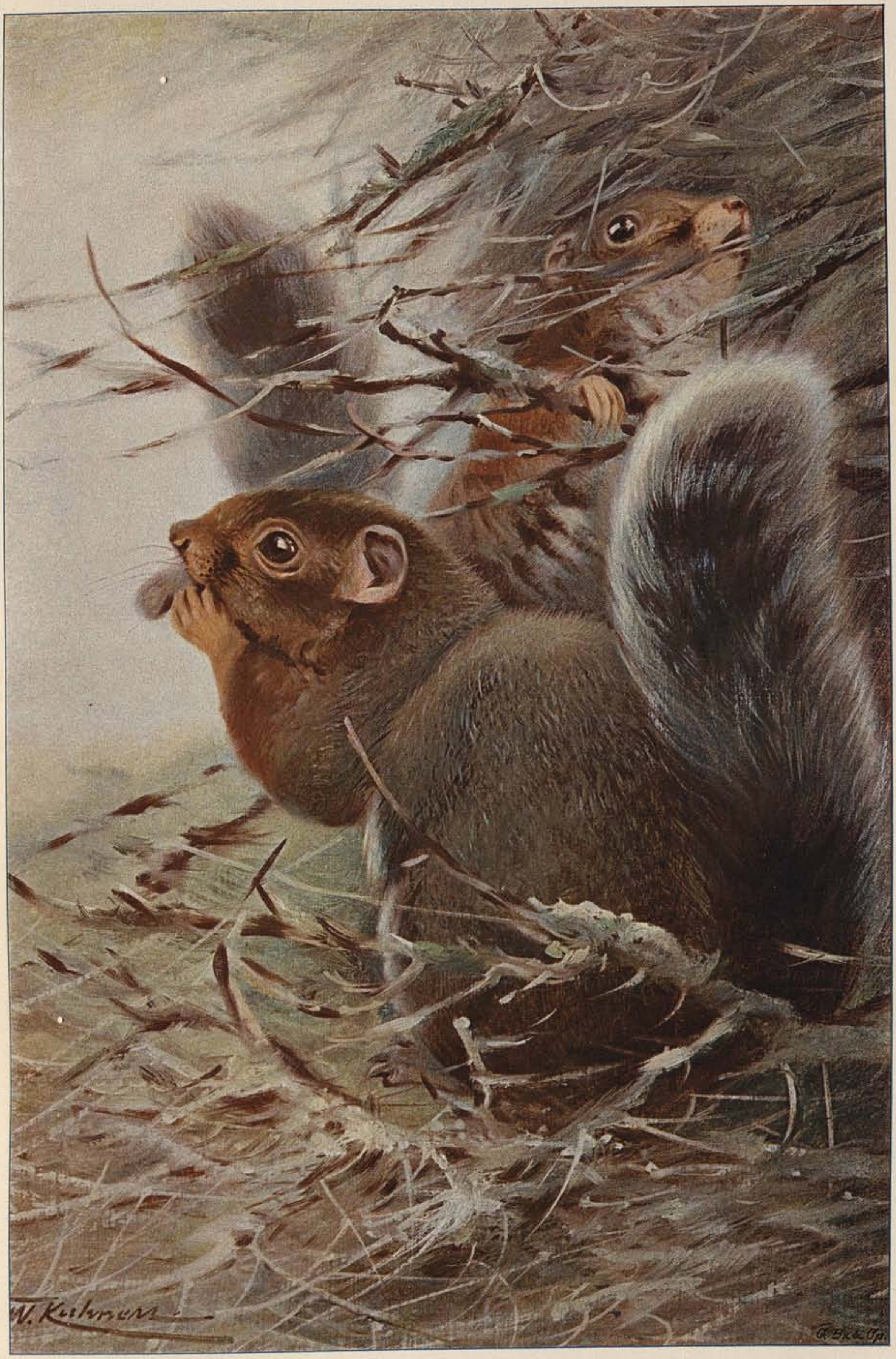
St. Paul's squirrel (*Funisciurus pauli*), from the Usambara and Tanga districts of East Africa, may be taken as a good representative of another exclusively African genus, and is specially characterised by the brilliancy of its colouring which well-nigh rivals that of some of the Malay species. *F. poënsis*, typically from Fernando Po, but also found on the mainland from Liberia to the Gabun, is another member of the same group. On the other hand, the red-bellied squirrel (*Heliosciurus rufobrachiatus*) and Stanger's squirrel (*H. stangeri*) of the west coast are well-known representatives of a second genus. Typically from the east coast, the first-named species ranges right across Africa, but has been divided into several local races, such as *H. r. libericus*, *H. r. ruwenzorii*, and *H. r. pasha*, the last of which is from Monbuttu.

Very distinct is the pigmy squirrel (*Nannosciurus minutus*) of the Gabun, which differs from its Malay relatives by having one pair less of premolar teeth in each, so that the total number of cheek-teeth is $\frac{4}{4}$ instead of $\frac{5}{5}$ pairs. On account of this slight difference, it has been proposed to separate the African pigmy squirrel from its Malay cousins as *Myosciurus*.

Africa has no representatives of the flying representatives of the *Sciuridæ*, nor of the large Indo-Malay squirrels of the genus *Ratufa*, so that its squirrel fauna is of a very peculiar and characteristic type.

Dormice. The dormouse family (*Gliridæ*) is well represented in Ethiopian Africa, the genus *Graphiurus*, characterised by its feather-like tail, of which the Cape *G. ocularis* is one of the largest representatives, being restricted to this part of the world.

Mouse Tribe. Very brief mention must suffice for the mouse and rat family (*Muridæ*), of which there are a considerable number of genera peculiar to the region under consideration. In addition to the presence of this group of genera it is of importance to note the absence from this region of the short-tailed field-mice (*Microtus* and *Evotomys*) of the northern continents. The peculiar



St. Paul Squirrel.

genera include the graceful little tree-mice of the genus *Dendromys*, together with the allied genera *Limacomys*, *Steatomys*, and *Lophuromys*; other genera being *Pachyuromys*, *Mystromys*, which is solely South African, *Otomys*, as represented by the so-called veldt-rats of south-eastern and western Africa, *Dasymys*, which is restricted to South Africa, and the West African *Malacomys* and *Deomys*. To describe the distinctive features of these mice and rats would occupy more space than can be afforded. Easily recognised by its great size, which, exclusive of the long tapering tail, is nearly equal to that of a rabbit, is the giant Gambian rat (*Cricetomys gambianus*) of the west coast, where is found another peculiar genus, *Saccostomus*, represented by the two species of pouched rats.

By far the most generally interesting of the Ethiopian *Muridæ* are, however, the crested rats of the genus *Lophiomys*, of which there are several species ranging from Shoa to East Africa. These rats, which are arboreal in habit, are twice the size of an ordinary rat, and derive their name from the crest of long erectile hair running down the middle of the back and tail. With the exception of a broad band running along each side of the body, where it is quite short, looking as though it had been clipped, the body and tail are clothed with long, shaggy hair, which is of a curiously spongy nature at the root. In colour the Shoan species (*L. imhausi*) is dark grey, due to the admixture of black and white hairs, with a triangular white spot on the face, a white streak below each eye, and a white tail-tip. The band of short hair on the side of the body is probably of a glandular nature. The skull is remarkable for the fact that the temporal region is roofed over with an arched sheath of bone in the same manner as is that of a turtle. These crested rats have no near relatives in any part of the world.

In Uganda crested rats are reported to live in hollows in trees, particularly junipers, and their habits appear to be very similar to those of tree-hyraxes. Their diet is entirely vegetarian, but their food-plants are probably different from those of hyraxes, for while these rats are easy to feed in captivity, and will eat almost every kind of green food, it is stated to be difficult to keep a tree-hyrax alive more than a week or so. Crested rats appear to have two young ones at a birth, the newly born young being silver-grey in colour with a little bare line along each flank. According to native reports, the adults live in pairs, and if one is taken out of a hole its mate may be taken by going to the same hole next day. They do not appear to utter a particular cry, but when frightened make a peculiar clicking noise with their teeth.

Sand-Mole Group. An Ethiopian family of rodents, the *Bathyergidæ*, is typified by the so-called sand-mole (*Bathyergus maritimus*), of the coast districts of Cape Colony and thence northwards along the west coast to Namaqualand. It is restricted to sandy districts, where it forms burrows and throws up heaps a foot or more in height. In length this rodent measures nearly 18 inches, inclusive of the very short tail; its colour is uniform slaty grey. The short legs are furnished with four or five toes terminating in powerful claws. The orange-coloured incisor teeth are so large that they cannot be covered by the lips; external ears are wanting, but bright, shining eyes of the size of a pin's head are buried in the fur. An allied species (*Georychus capensis*), representing a second genus and locally known as the bles-mole, is also a native of the south and south-west as far as

Namaqualand, but is not restricted to sandy tracts. The burrow of this species is furnished with a central chamber in which the owner accumulates a store of bulbs and tubers or other food. This creature is only about half the size of the sand-mole, from which it is distinguished by the smooth, instead of grooved, front surfaces of the upper incisor teeth, and the very much weaker claws. A second species of the same genus, *G. damarensis*, inhabits Damaraland and Angola, a third, *G. darlingi*, occurs in Mashonaland, a fourth, *G. nimrodi*, in the neighbourhood of Buluwayo, while a fifth, *G. hottentotus*, is the mole-rat of the eastern side of Cape Colony and Natal.

SAND-MOLE.

The most remarkable members of the family *Bathyergidæ* are, however, the curious little naked sand-rats of north-eastern Africa, of which *Heterocephalus glaber* inhabits central Abyssinia, while *H. philippsi* is a native of the deserts of the interior of Somaliland. These remarkable rodents, which are not much larger than ordinary mice, have almost naked skins, and are further characterised by the small head, minute eyes, the absence of external ears, the moderately long tail, and the powerful fore-feet, each provided with a pair of fleshy pads. Of cheek-teeth there may be either two or three pairs in each jaw. These sand-rats appear to be degraded types allied to *Georychus*, and specially adapted for a subterranean life in the sands of the desert. One species inhabits British East Africa.

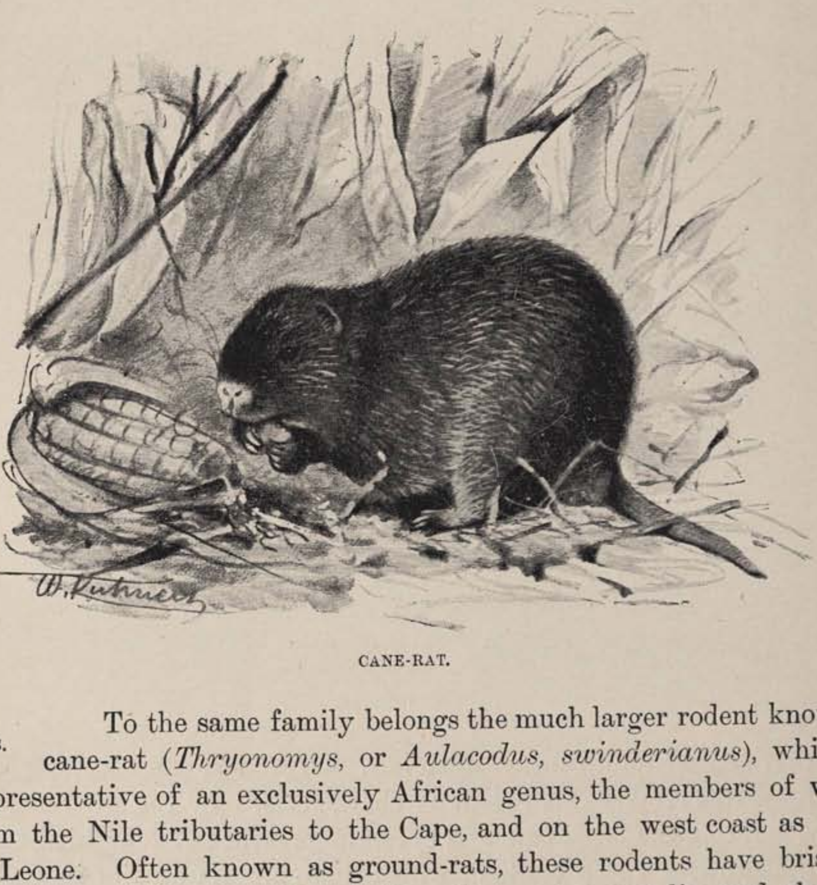
Root-Rats. The allied family of *Spalacidæ*, as typified by the great blind mole-rat (*Spalax typhlus*) of eastern Europe, south-western Asia, and Egypt, has Ethiopian representatives in the root-rats of the genus *Tachyoryctes*, which were long included in the same genus as the bamboo-rats (*Rhizomys*) of south-eastern Asia. Several kinds of these Ethiopian root-rats have been described, such as *R. macrocephalus* of Abyssinia, *R. splendens*, ranging from Abyssinia to German East Africa, and the East African *R. annectans*.

Jumping-Hares. Very characteristic of South Africa is the so-called spring-haas, or jumping-hare (*Pedetes caffer*), which, with a second rather smaller species, alone represents the family *Pedetidæ*, of which the nearest affinities appear to be witn the porcupines, or *Hystricidæ*. Of a size approaching that of an ordinary hare, this remarkable rodent is characterised by the great length of the hind-limbs and tail, the large ears and eyes, the presence of four hind-toes, and the rootless, ever-growing cheek-teeth, of which there are four pairs in each jaw. In colour the moderately long and soft fur is bright rufous above and white beneath, with some black on the face and at the tip of the tail, which is thickly haired throughout its length. The head and tail measure about 2 feet and the tail is 21 inches in length. The range of the jumping-hare extends from the Cape westwards into Angola, and on the opposite side of the continent to German East Africa. These rodents are found alike on the mountains and the plains, and in their mode of life are much like jerboas, being entirely nocturnal, and constructing complicated burrows in which several families dwell together. While feeding they go on all fours, but, when travelling, they leap like

JUMPING-HARE.

kangaroos, going faster uphill than down, but in neither case attaining any very great speed.

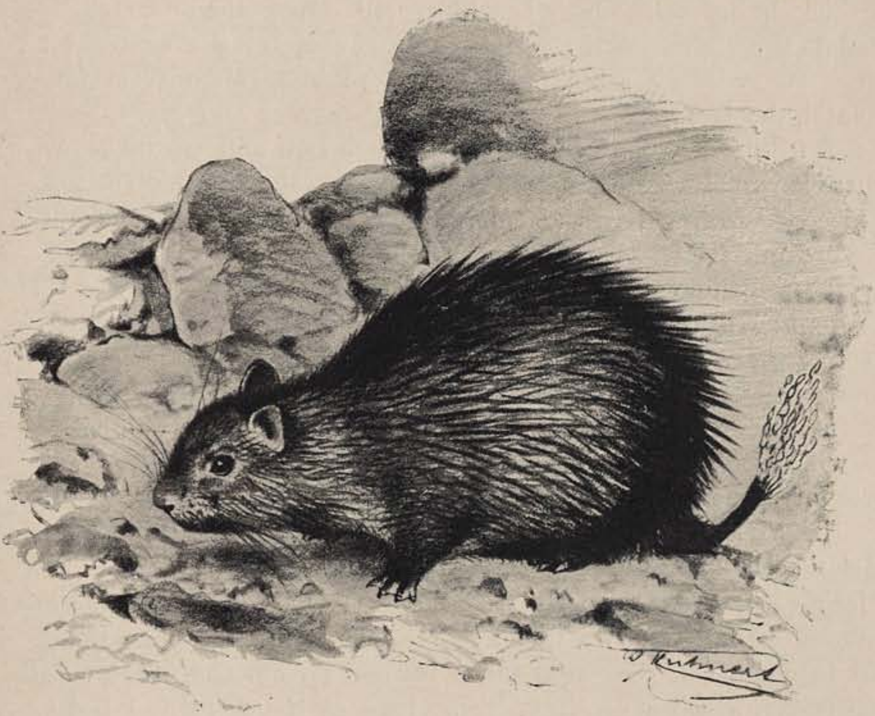
Rock-Rat. The typically South American degu family (*Octodontidæ*) has a few African representatives, among which is the rock-rat (*Petromys typicus*) of Namaqualand. Brownish grey in colour, this rodent measures about 6 inches to the root of the tapering scaly tail, of which the length is only half an inch less than that of the head and body. The feet are five-toed, although in the front pair the first toe is reduced to a mere tubercle; the soles of the front toes having five and those of the hind pair six pads. Rock-rats are restricted to stony districts, where they may be seen abroad at all times of the day, in search of the flowers which form their chief food. At night they sleep safely curled up in rocky clefts or beneath protecting boulders.



CANE-RAT.

Cane-Rats. To the same family belongs the much larger rodent known as the cane-rat (*Thryonomys*, or *Aulacodus, swinderianus*), which is the typical representative of an exclusively African genus, the members of which are found from the Nile tributaries to the Cape, and on the west coast as far north as Sierra Leone. Often known as ground-rats, these rodents have bristly coats speckled yellow and brown, with a white chin and upper lip, and short broad ears. In length the tail measures 7 inches, and the head and body 19 inches. The lower front teeth are smooth, but the upper pair are marked with three deep vertical grooves, and are so powerful that the marks of their grooves have been detected on ivory gnawed by these rodents. In South Africa cane-rats appear to make for their retreat a sort of nest constructed in the ground amid a tangle of grass and reeds from which they can with difficulty be driven. They feed on roots, tender shoots, and the sugar-cane from which they take their name.

Porcupines. The typical porcupines are represented in Ethiopia by the widely-spread *Hystrix afræ-australis*, the range of which extends from German East Africa and French Congoland to the Cape. From the porcupine of southern Europe and northern Africa this species differs by the much greater length of the frontal bones of the skull. Inclusive of the 8-inch tail, it has a total length of about 31 inches. In connection with the tail of the porcupine it may be mentioned that many naturalists regard the rattle of the rattlesnake and certain structures connected with the mechanical production of sound in some scorpions and giant spiders as warning organs; that is to say, the sounds they produce are intended to give notice of the approach of a dangerous creature. How this arrangement works in the case of carnivorous creatures like rattlesnakes, which, it might be thought, must drive away their own prey, does not appear; but no doubt the believers in the theory have a full and satisfactory explanation of the difficulty. No such difficulty arises in the case of the porcupine, whose tail has a function similar to that of the snake's rattle. Unlike most nocturnal animals, porcupines, when prowling about at night, make as much noise as possible by rattling their quills and continually grunting. In spite of their array of spines, porcupines are easy to kill on account of their thin skins, which are easily torn; and a properly trained dog, which knows where to get a safe grip, will shake one to pieces in a few seconds. Hence the object of endeavouring to frighten other animals by bluster; the porcupine, in fact, playing a bold game of bluff.



BRUSH-TAILED PORCUPINE.

As a member of a genus common to equatorial Africa and the Malay countries, special mention may be made of the African brush-tailed porcupine (*Atherura africana*), the range of which includes West and Central Africa.

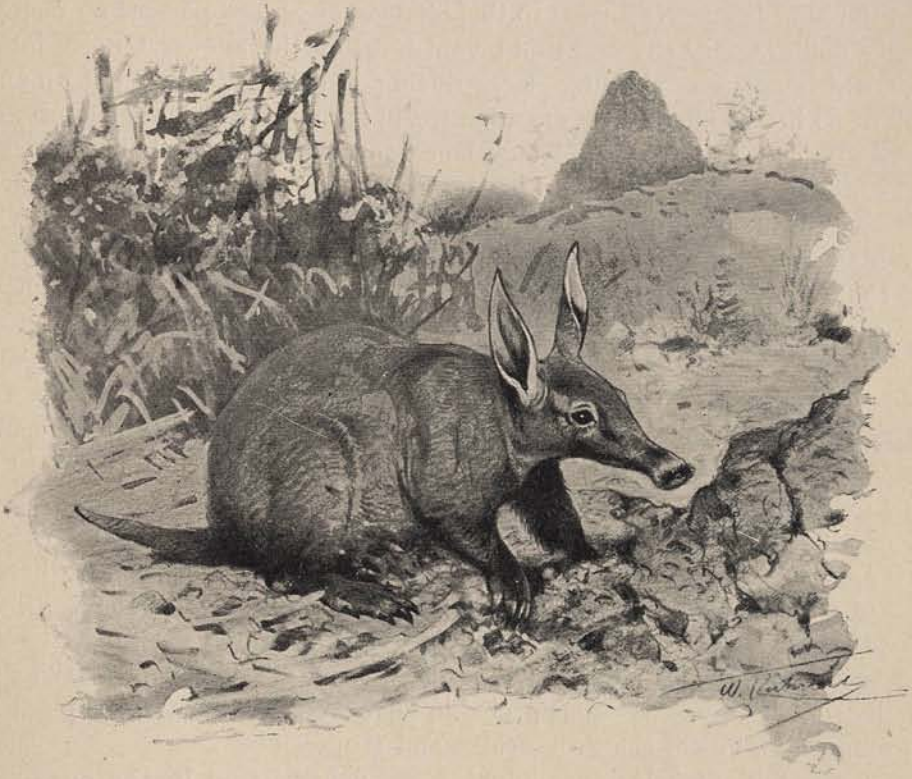
Hares and Rabbits. Of the hare family, *Leporidæ*, the rock-hare (*Lepus saxatilis*) inhabits uplands and hills from Cape Colony to the Zambesi. Measuring about 26 inches in length, exclusive of the tail, this species has longer ears and legs than the European brown hare, and a coat yellowish brown in colour speckled with black above and white below. A second species is the Cape hare (*L. capensis*), of much the same colour, but without the rufous tinge on the neck and back or the yellow on the throat. When in flight, it carries its ears erect, and its legs are shorter than those of the preceding species. Its range extends from German East Africa and French Congoland to the neighbourhood of Cape Town. Very characteristic of South Africa are the small group of red-rumped rabbits, typified by *L.* (or *Oryctolagus*) *crassicaudatus*, a species taking its Latin name from the thick bushy tail, which is wholly red. In build and size this species, which inhabits the highlands of Cape Colony and some of the adjacent territories, is very like an ordinary rabbit. Red-tailed rabbits range from Cape Colony through Natal, the Orange River Colony, the Transvaal, and Nyasaland. It may be added that in the Cape hare the tail is black above and white below, while in the rock-hare it is white with a narrow black line on the upper surface.

The picas, or calling hares (*Lagomyidæ*, or *Ochotonidæ*) of central Asia are quite unknown in Africa.

Pangolins. Ethiopian Africa is remarkable as being the only country in the Old World which is the home of two generic representatives of the order Edentata, of which the headquarters are in tropical South America. Of the African genera, one is peculiar to Ethiopia, while the other is common to south-eastern Asia: each represents a family by itself. The pangolins, or scaly ant-eaters, which look as if they were clothed in the scales of the cones of some giant species of spruce-fir, are such well-known animals that no description is here required. The African pangolins, although belonging to the same genus (*Manis*) as their Asiatic cousins, are distinguished from the latter by the absence of external ears, the lack of hairs between the scales, and the duplication of the middle row of scales about the middle of the upper surface of the tail. Among the species, the long-tailed pangolin (*M. macrura*) takes its name from the great length of the caudal appendage, which is nearly twice as long as the head and body; a second distinctive feature being the absence of scales on the lower part of the outer side of the fore-legs. The white-bellied *M. tricuspis*, which ranges right across the central regions of the continent, differs by the size and shape of the scales, the free margins of which are tricuspidate, and also by the white under-parts. The shortness of the tail—only some 18 inches in length—serves to distinguish *M. temmincki*, in which the head and body measure about 2 feet: the range of this species extends from Somaliland along the east coast to the Cape and thence to Angola. Largest of all is the giant pangolin (*M. gigantea*), of West Africa, which resembles the short-tailed species in the absence of a bare spot on the under surface of the tail characteristic of the long-tailed and white-bellied species.

In habits the two latter are arboreal, whereas the other two live on the ground. The short-tailed species burrows in hard, stony soil, and has the power of rolling itself into a ball. When first born, the young of all the species have the scales soft and flexible. Pangolins, which are mainly nocturnal, have no teeth, and feed by licking up ants—especially white ants—by means of their long, extensile, worm-like tongues.

Although, as already stated, adult pangolins are toothless, microscopic examination of the jaws of a fœtus of a Malay pangolin has revealed the presence of minute outgrowths which appear to be the last remnants of teeth, as they seem structurally different from hairs. So far as can be determined, these structures, of which there are thirteen or fourteen pairs in the lower jaw, indicate simple peg-like teeth, comparable to those of armadillos. The number of pairs in the upper jaw is considerably less.



ANT-BEAR.

Ant-Bear. Perhaps the most remarkable of all African mammals is the ant-bear or aard-vark (*Orycteropus afra*), which has several local races distributed, in suitable situations, all over Ethiopia from Abyssinia and Somaliland to the Cape. The ant-bear, which has no near relations in any part of the world, is an unmistakable animal, of the size of a small pig, with a long head, terminating in a blunt, pig-like snout pierced by the circular nostrils, a tubular mouth devoid of front teeth, long ears, and a short neck. The fore-quarters are low, the back is much arched, and the hind-quarters pass imperceptibly into a thick cylindrical tail tapering gradually from root to tip. The short but powerful limbs are armed in the front pair with four strong claws for digging, and in the hind pair with five of a shorter type. The thick hide is generally yellowish brown in colour, and more or less sparsely covered with rather long coarse hair, of which the colour varies locally from brown to grey. Inclusive of the tail, the length of the animal may be nearly 6 feet. The cheek-teeth, which are preceded by a milk series, are in the form of flat-crowned columns, those in the hind part of the series being bilobed: internally they have an altogether unique structure.

Districts abounding in hillocks made by white ants are the favourite resorts of ant-bears, which tear open the sides of these elevations and feed on their inhabitants by licking them up on their long extensile tongues. They are adepts in burrowing, and even in hard ground are able to dig holes large enough to contain their bodies within a few minutes. Digging is accomplished by the four large but blunt claws of the fore-feet; the earth being thrown out backwards between the hind-legs. Nocturnal in their habits, ant-bears possess an acute sense of hearing, and are very shy and timid, vanishing at the slightest noise into their burrows, which serve as sleeping-places during the day. To dig out an ant-bear is a task of no little difficulty, as the creature, in favourable ground, can often work faster with its claws than can its would-be captors with pick and spade.

Dolphin and Manati.

The rivers and estuaries of Africa are not altogether without representatives of the two purely aquatic orders of mammals (Cetacea and Sirenia), although there is no exclusively fluviatile genus corresponding to the susu of the Ganges or the inia of the Amazon. The Bight of Biafra is, however, the home of the Camerun dolphin (*Sotalia teuszi*), a member of a long-beaked estuarine genus, which has been reported to differ from all other cetaceans by subsisting on vegetable food, although the statement requires confirmation.

In several of the West African rivers is to be found the African manati, or sea-cow (*Manatus senegalensis*), a member of the order Sirenia. Although sirenians present a certain superficial resemblance to whales and dolphins, they have no sort of affinity with the Cetacea, being of totally different origin. Whales and dolphins appear, indeed, to be derived from primitive land Carnivora, whereas the affinities of the sea-cows are with the proboscidean, or elephant, group. Since the extinct genera which appear to form a connecting link between an extinct group of land Carnivora and the Cetacea are found in the Tertiary formations of the Fayum district of Egypt, it seems probable that Africa was the birthplace of the latter group, as well as of the Proboscidea and Hyracoidea.

Sea-cows, unlike whales and dolphins, are never found in the open sea, but frequent shallow estuaries and rivers, where they subsist entirely on vegetable food. Of the two living generic types, the manatis are found in the rivers and estuaries of both sides of the tropical Atlantic, whereas their cousins the dugongs (*Halicore*) are restricted to the coasts of the Indian Ocean and the tropical Pacific. The group was, however, not always restricted to tropical waters, as somewhat more than a century ago a much larger species (*Rhytina gigas*), the sole representative of its genus, abounded on the frozen shores of Bering Island, where it was exterminated shortly after its discovery by shipwrecked sailors. The African manati, which is peculiar in having but six vertebræ in its neck, in place of the normal seven, attains a length of about 8 feet. The rugged black hide bears a few sparse hairs, which tend to disappear with advancing years, the tail is broad and rounded, and the sides of the jaws are armed with a series of tuberculated molar teeth, quite unlike those of the dugongs, which have, moreover, a pair of stout upper tusks. The nostrils, as in the other members of the group, are placed at the apex of the muzzle, and provided with flaps by means of which they can be closed at will. The lips are altogether peculiar in structure, the upper one being cleft in the middle line, and its two halves working against one another. The name manati refers to the hand-like action of the flippers when the female is supporting herself nearly upright in the water and pressing her offspring to her breast. Sea-cows rarely, if ever, come completely out of the water.

Certain evidence was published in 1912 tending to show that the ancestors of sea-cows had scaly hides, resembling in this respect the early cetaceans, although it does not appear that the scales were underlain by plates of bone.

RÜPPELL'S VULTURE.

CHAPTER IV

The Birds of Ethiopian Africa

A considerable percentage of the bird-fauna of the geographical region under consideration is formed by species which breed in Europe or northern Asia and migrate southwards at the commencement of the northern winter to seek a second summer in Africa. To refer to such species in this chapter would be superfluous, as many of them have been mentioned under the headings of Europe and Asia, while they are in no wise characteristic of the Ethiopian region. Attention may accordingly be concentrated on a limited number of groups or species of birds more or less completely restricted to the Ethiopian region, and of special interest on account of their habits, distribution, or affinities.

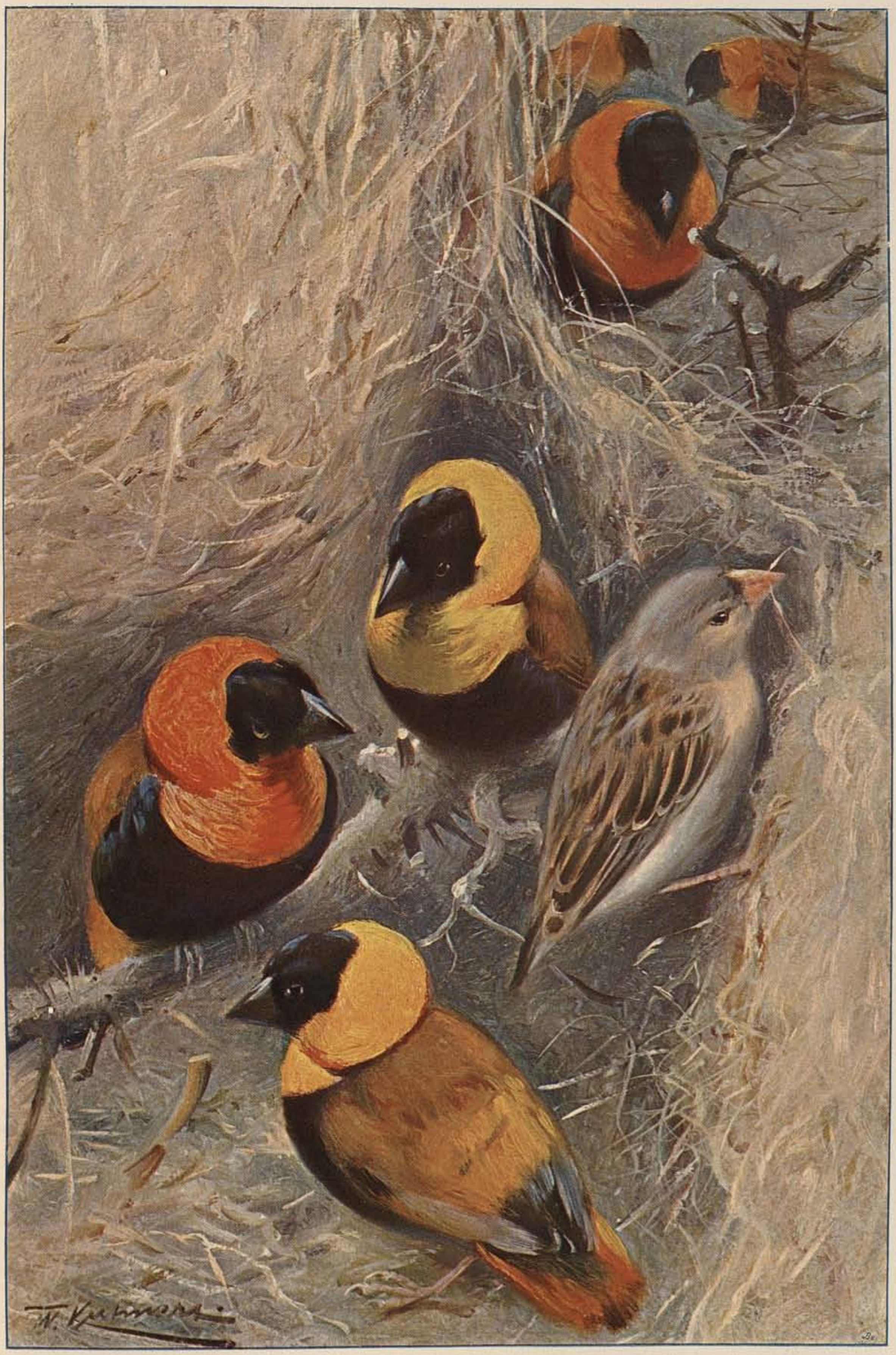
Perching-Birds.

In the great group of perching-birds, or Passeres, a prominent position is occupied in Africa by the gorgeously coloured sun-birds (*Nectariniidæ*), which are widely distributed in the Old World, and recall the humming-birds of America, with which, however, they have no relationship. Among the African representatives of the family, the long-tailed *Promerops caffer* attracts attention by the great elongation of the tail, in which the feathers are graduated, with the two middle pairs longest of all. This bird, which approximates in size and colour to a reed-warbler, is dark brown above with a greenish rump, and rusty brownish white below, the under tail-coverts being yellow, and the throat white with a dark brown streak. Its cup-like nest is constructed mainly of grass and fibres, and placed in low bushes; while the eggs, in their purplish brown blotches and streaks, recall those of the buntings. In the wagtail group (*Motacillidæ*) the exclusively Ethiopian genus *Macronyx*, characterised by the yellow or red colouring of the under-parts, is represented by several species; among them is the Cape wagtail (*M. capensis*), of the southern districts, a bird rather larger than a crested lark, and of somewhat similar colouring above, but with an orange and black-edged throat.

LONG-TAILED SUN-BIRD.

The so-called sociable grosbeak (*Philetærus socius*) belongs to the weaver-bird group, *Ploceidæ*, one section of which is peculiar to Ethiopia. The sociable species is chiefly noteworthy on account of its breeding-habits, the huge nest, which is constructed with a roof of straw, being the work of some three hundred pairs of birds. In shape and size recalling a hay-cock, this remarkable structure is usually built in thorn-trees, with the entrance on the lower surface, so that it also serves as a protection against wind and rain. These nests, which are constantly being repaired, are stated to last for years. In appearance and colour the cocks resemble sparrows, but the hens are paler. To the same family belongs the striped finch (*Amadina fasciata*), a tropical species with its plumage coloured a mixture of reddish brown and black, the cheeks and chin of the cocks having a broad red stripe, and the margin of the upper half of the beak being festooned. Somewhat smaller is the so-called lesser magpie (*Spermestes cucullatus*), a species also confined to the tropics, which has been introduced into the West Indies, and is often seen in cages in Europe. It derives its name from the magpie-like style of colouring. The head and throat are glossy black, the back and wings brown, the shoulders and a spot on each side of the breast blackish green, and the breast and middle of the under-parts white. Somewhat similar is the parti-coloured lesser magpie (*Lepidopygia bicolor*), which has black-and-white plumage and occurs on the west coast. A number of species allied to the rose-finches, such as the orange-cheeked finch (*Sporæginthus melpodus*), the gold-breasted finch (*S. subflavus*) of tropical Africa, the scarlet-rumped finch (*Coccopygia dufresnei*) of South Africa, the blood finch (*C. minima*) of the equatorial zone, and the white-spotted finch (*Hypargus niveoguttatus*) of East Africa, are also characteristic types.

The exclusively African masked weavers are about the size of linnets, but in colouring come nearer the yellow-hammer on the back, wings, and tail, some species having, however, red on the head and beak. These birds associate in pairs or small companies during the breeding-season, but after the young are fledged wander over the plains in large flocks in search of grass-seed, and build pouch-shaped nests on the tops of high trees. A well-known representative of the group is the red-headed weaver (*Quelea erythrops*) of West Africa, taking its name from the red skull-cap. The crimson weavers, again, or bishop-birds (*Pyromelana*), as typified by the South African *P. oryx*, form a group represented by numerous species, in which the winter plumage of the cocks and the dress of the females at all seasons is much like that of a yellow-hammer, but the breeding livery of the males is black and red or black and yellow, the feathers on the head and throat being short and velvety in texture. These birds also live on grass-plains, where they wander about in family parties, building their oval-domed nests, furnished with conveniently placed exits, amid the stems of high grass, to which they are attached. The eggs are either plain blue, or with sparse specklings of black or red on a blue ground. While the hen is sitting the cock takes his station on a bush or tree close by, where he puffs out his body and swells his plumage until the body becomes almost as round as a ball, and he at the same time performs various strange evolutions. The velvet-weavers (*Diatropura* and *Coliostruthus*) differ from the crimson weavers by the round, graduated tail, which is sometimes nearly the same length as the wings but in other cases longer. The breeding-plumage of the cocks is velvety black marked with red or yellow. In habits these birds much resemble the crimson weavers, although they do not whirr through the air, but fly in jerks with the body rather stiff. The nest is exactly like that of the crimson weavers, but the eggs are spotted with grey on a greenish ground. The cock performs similar antics at the breeding-season, puffing out his plumage and erecting his neck-feathers, rising suddenly from his perch to ascend vertically into the air, and then slowly descending. In this group the cock-tailed whydah (*D. progne*), a bird about the size of a starling, is a South African species in which the females differ from the males by having red on the shoulders. The males themselves, which are black with vermilion wing-coverts and a white patch on the breast, have long tails of gracefully curved feathers. The true whydah, or widow, birds, often classed with the velvet-weavers, are distinguished by the lighter beak and the absence of the short velvet-like plumage on the head and throat, as well as



WEAVER BIRDS.

by the possession of a straight non-graduated tail which in winter is of about the same length as the wings. The four middle feathers of the males in breeding-plumage are, however, very long, twisted, and spatulate at the tips, the base of each having a hair-like filament which originally adhered to and ran along the edge of the outer web. The males are black, black-and-white, or black-and-brown, but in winter their plumage is of the same dull colour as that of their partners. These birds inhabit open plains, but do not build in grass, preferring trees and bushes, and making use of leaves which they weave together after the manner of tailor-birds. Sometimes they breed in niches in walls, where they build nests like those of sparrows. One of the best known species of this exclusively Ethiopian group is the paradise-whydah (*Steganura paradisea*), a bird hardly so large as a sparrow, which is distributed over the greater part of Africa. On the other hand, the steel-finch (*Hypochæra chalybeata*) is a West African species, often brought to Europe; in the north-east and east this is replaced by the atlas-bird or satin-bird (*H. ultramarina*), whose plumage is bluish green metallic black, with a tuft of white silky feathers on each side of the upper tail-coverts, while the beak and feet are bright red. From the steel-finch it is distinguished by the deep blue sheen of the feathers deepening to violet. With the tree-weavers, typified by the Asiatic genus *Ploceus*, as now restricted, but represented by allied African generic groups, we reach a group of which a well-known southern representative is the handsome *Hyphantornis spilonotus*, distinguished by the predominance of golden yellow, with black on the sides of the head and throat.

That the South African honey-

COCK-TAILED WHYDAH.

guides (*Indicatoridæ*) are parasitic in the matter of egg-laying has been long known, and it appears that this habit is shared by certain members of the whydah-bird group; this parasitic habit having been demonstrated in the case of the pied whydah-bird (*Vidua serena*), while it is probable that the same holds good in the case of the typical species of the genus *Quelea*, which deposits its eggs, at all events in some instances, in the nests of another member of the same family, namely, *Pyromelana oryx*.

Exclusively Ethiopian are the parrot-weavers, characterised by their short, arched beaks with compressed sides and prominently ridged culmen, and distinguished from other weavers by the dark brown plumage and white wings. These birds are active climbers, and have a habit of hanging head-downwards on the clusters of fruit like crossbills. They inhabit marshy districts, where they perch on the withered branches of trees, and build closely woven nests of conical shape provided with an exit on one side. The eggs are flecked with pale red on a white ground. A species often seen in cages is the white-browed parrot-weaver (*Amblyospiza albifrons*), a dark brown bird shading to black beneath, with a white forehead and white flecks on the black tail and wings. This weaver, which is about the size of a hawfinch, is restricted to south-eastern Africa. Another African group, that of the sparrow-weavers, comprises several species of small, sparrow-like birds, with the same colouring in both sexes, which associate in pairs during the breeding-season, but afterwards collect in flocks in stubble-fields and pastures. The nest, which is shaped like an oven, is made of dry grass lined with feathers and other soft materials, and is accessible by a lateral entrance-hole situated near the under surface. Of these species the red-headed sparrow-weaver (*Vidua hypocherina*), of north-east Africa, is brown above and white beneath, with the upper part of the reddish brown head streaked with white; the other member of this genus, as now restricted, being the tropical *V. serena* (*principalis* or *superciliosa*). The bush-weavers (*Calyphantria*), represented by a small number of species in Madagascar and the adjacent islands and south-eastern Africa, build nests resembling those of the crimson weavers: in the cock of the common species the head and throat, and often the upper part of the body, are red, while the back and wings show only a slight tinge of that colour. The hens are dull-coloured, sparrow-like birds. A black and red plumage, in both sexes, is distinctive of the weavers of the genus *Malimbus*, of which the shining weaver (*M. nitens*), a black bird with a deep red breast, is a well-known West African representative. These birds construct artistic flask-shaped nests, suspended from boughs. More generally known is the ox-bird or buffalo-weaver (*Textor albirostris*), a north-east African black bird rather larger than a starling, with a white margin to the middle wing-feathers and an ivory-white beak. In South Africa this is replaced by the red-beaked *T. niger*, in which the head is white.

With the so-called ox-peckers we reach an exclusively African group of the starling family (*Sturnidæ*). These birds are represented by two well-known species, both of which have short, straight, blunt, and rather curiously formed red or yellow beaks, and graduated tapering tails. Ox-peckers take their name from their habit of associating with the herds of antelopes, elephants, and other large mammals, from the backs of which they pick the vermin

In this mode of life they closely resemble the buffalo-weavers, or ox-birds, already mentioned. The better known of the two is the common ox-pecker (*Buphaga africana*), a species earthy-coloured above and pale rufous brown on the lower part of the back and under-parts, with a range extending over Africa generally. In this species the beak is yellow tipped with red, but in the second species, *B. erythrorhynchus*, which ranges from Abyssinia to Natal, it is wholly red. The glossy starlings form another very characteristic group of African birds. They have short, slightly curved beaks, and are distinguished by the beautiful metallic sheen of their plumage. While some are forest-dwellers, frequenting the summits of high trees, others prefer open country. All resemble ordinary starlings in flight and song, but their long tails and relatively large bodies make them look more like magpies. In the breeding-season these birds associate in flocks and nest in the hollows of trees, while later on they wander about in flocks with their young. The bronze-starling (*Lamprotornis æneus*) of West Africa, the amethyst-starling (*L. eytoni*), the copper-starling (*L. porphyropterus*), and the green glossy starling (*L. chalybæus*) of north-eastern Africa are well-known members of this group.

OX PECKERS AT WORK.

The crow tribe (*Corvidæ*) is represented in Ethiopian Africa, as well as in Madagascar, by the white-bellied crow (*Corvus scapulatus*), a species with a white gorget and white on the breast, but otherwise glossy black, and of about the size of an ordinary crow. The thick-billed raven (*Corvultsur crassirostris*) of north-eastern Africa takes its name from its massive beak. On the Gold Coast is found the wagtail-crow (*Picathartes gymnocephalus*), a slaty grey bird about the size of a jackdaw, with a bare yellow patch on the face. The throat is scantily covered with white down, but the white under-parts are more closely feathered, while the wings and tail are dark brown. The Senegambian taper-tailed magpie (*Cryptorhina afra*), which, like the preceding, is the sole representative of its genus, may be recognised by the long beak, pointed wings, and graduated tail formed of ten feathers. In colour it is glossy black shading to dark brown on the wing-coverts and tail.

Nearly allied to the crows are the spectacled shrikes, which form a purely African group distinguished by the fleshy wattle round the eyes, the stiff frontal feathers overhanging the nostrils, and the long straight beak. The black-headed species (*Prionops poliocephalus*) is an East African bird, black and white in colour, with a grey neck and ear-patches. The snake-shrikes (*Eurycephalus*), characterised by their short, notched beaks, form a group restricted to East and South Africa; while their relatives the magpie-shrikes (*Urolestes*) have a somewhat wider range. They are distinguished by their graduated tails with the two middle feathers greatly elongated, the lanceolate feathers on the crown and neck, and the long, fluffy plumage of the flanks. The typical *U. melanoleucus* takes its name from the black plumage tipped with white on the shoulders and wings.

To the flycatcher group, *Muscicapidæ*, belong the pied woolly snappers (*Platystira*), comprising very small birds with thick, soft plumage, a flap of skin round each eye, and the beak surrounded by bristles. Closely allied are the grey snappers, as represented by the typical South African *Stenostira scita*, and certain allied genera. In these birds the plumage is of somewhat the same type as in the last, but the beak is narrower; most of the species are African, although one inhabits Madagascar.

In concluding this necessarily brief notice of the Ethiopian perching-birds it may be mentioned, as a curious fact in distribution, that the Angola pitta (*Pitta angolensis*), of the west coast, is the sole African representative of a group otherwise restricted to tropical Asia, Australia, and America.

Picarian Birds.

Among the so-called picarian birds, the nightjars are especially well represented in Ethiopian Africa, one of the most remarkable being the pennant-winged nightjar (*Macrodipteryx* [*Cosmetornis*] *vexillarius*), distinguished by the great length of the seventh, eighth, and especially the ninth primary quills of the wing, which are white, and appear to attain their extreme development only from October to January, and then solely in the males. On account of these encumbrances, the cocks have a much slower flight than the hens, which are so swift as to be difficult to follow with the naked eye. The species ranges from the Niger delta to the Zambesi and Damaraland. In the second nightjar of the same genus, *M. longipennis*, inhabiting Abyssinia and the west coast between the Senegal and the Niger, the elongation is confined to the ninth primary quills in which the shafts are long and bare, terminating in short, spatula-like vanes. When the birds are sitting on the ground, these standard-like feathers are frequently held vertically; while in flight they communicate a most remarkable appearance to their owners.

In another family group the yellow-beaked purple roller (*Eurystomus afer*) represents a genus ranging from central Africa through Asia and Australia to New Zealand. In colour this bird is cinnamon-brown above and violet below, with the sides of the head purple, the lower tail-coverts pale blue, the wing-coverts dark blue, and the tail pale blue at the base and dark blue at the tip. The European blue roller (*Coracias garrulus*) occurs in the northern districts, while other members of the same genus range all over the continent. The wood-hoopoes, which are restricted to Africa, and form a subfamily of hoopoes (*Upupidæ*), are birds with long, wedge-shaped tails and the fourth and second toes partially connected with the others. In flight they use the wings of opposite sides alternately. These birds associate in small numbers in the tops of tall forest trees, where they hang in titmouse-fashion from the boughs, and climb to obtain their food, which

RED-BEAKED WOOD-HOOPOE.

consists mainly of insects. The red-beaked wood-hoopoe (*Irrisor erythrorhynchus*), of central and South Africa, is about the size of an ordinary hoopoe, but appears more slender in shape owing to the long tail. While in colour the head and throat are bluish green, the rest of the plumage shows a metallic sheen of black, green, blue, and violet; each of the tail-feathers, with the exception of the middle pair, is marked with a circular white spot near the tip, and the beak and feet are red.

The wedge-tailed section of the hornbill family, *Bucerotidæ*, is represented by the two exclusively African genera *Lophoceros* and *Ortholophus*. Comparable in size to magpies, these birds are characterised by the lateral compression of the beak, which has its upper portion ridged or domed, but generally without a horn-like process. Among the numerous representatives of the first-named genus, the red-billed hornbill (*L. erythrorhynchus*) inhabits the north-eastern and north-western districts of the continent, while the brown hornbill (*L. melanoleucus*) is a southern type.

Very remarkable are the great ground-hornbills, which are birds of about the size of turkeys, obtaining their food on the ground, and resorting to trees only to breed and to rest. They build in the hollows of large trees, and feed on small mammals, reptiles, and insects. These birds, which are generally seen in the open, live entirely on the ground, and wander about in parties of five or six. It is believed that several females lay in the same nest, which is situated in a hole high up in the stem of a tree. Of the two species, one is *Bucorax* (or *Bucorvus*) *abyssinicus*, of north-eastern and western Africa, while the second (*B. cafer*) ranges from Cape Colony and South-east and South-west Africa to Equatoria. In the latter the large black casque is nearly or quite closed, although in the former it is open in front and ridged. In the two species the naked parts are respectively blue and red in the male and purple and blue in the female.

In the *Picidæ* mention may be made of the African green woodpeckers (*Dendropicus*), in which the upper-parts are either uniform olive-green or golden yellow, sometimes approximating to red, with dark brown and white or olive-yellow transverse barrings.

Closely allied to the woodpeckers is the widely spread family of barbets (*Capitonidæ*), which is well represented in Ethiopian Africa. Among the southern species, the Cape barbet (*Trachyphonus cafer*) is a brilliantly coloured bird of about the size of a spotted woodpecker, with a squared tail, like other members of the group. In colour it is bluish black marked with white above and yellow below, but the lower part of the back is also yellow, the upper tail-coverts are tipped with scarlet, and the orange throat is marked by a white gorget. The tooth-billed barbets take their name from the presence of one or two notches on each side of the upper half of the slightly curved beak, and are further characterised by the well-developed black bristles in front of the eye and under the beak. The West African *Pogonorhynchus dubius* is black above with crimson wing-coverts, cheeks, and ear-coverts, a white patch on the back, and the under-parts red blotched with yellow. An east coast species is the white-eared barbet (*Smilorhis leucotis*), a bird about the size of a sparrow, belonging to the exclusively Ethiopian group of tinker-barbets, typified by the genus *Barbatula*, of which *B. duchaillui* is a well-known western representative. In these birds the bristles over the nostrils are short and scanty, and the base of the upper margin of the beak forms a sharp ridge; all the species are tropical.

Africa is also the home of several of the curious birds known as honey-guides, which are regarded by some writers as forming a subfamily of the *Capitonidæ*, while by others they are classed as a family by themselves, *Indicatoridæ*. These birds, which are also represented in the Himalaya and the Malay Islands, may be compared to wrynecks, from which they differ by their curved beaks and more compact plumage. All of them feed upon insects, and more especially immature bees; but being of themselves unable to drag out the combs in which the latter live, they have the remarkable habit of attracting the attention of honey-badgers, or ratels, and human beings to the nests by their cries,

ABYSSINIAN GROUND-HORNBILL.

where they wait patiently until the contents are exposed, when they obtain a share. Occasionally these birds lead the way to nests barren of honey.

These birds are also parasitic in the matter of egg-laying. According to a recent account, the widely distributed African yellow-throated honey-guide (*Indicator major*) in most cases makes use of the nesting-hole of *Spreo bicolor*, a bird which, like the honey-guides themselves, lays white eggs. The honey-guide's eggs are, however, less elongated than those of its hosts, among which are certain species of swallows, as well as other birds laying white eggs. Whether the honey-guides lay more than one egg in the spreo's nest is not mentioned, but it is stated that these birds whenever possible break the eggs of their hosts with their beaks, thus ensuring that their own egg or eggs shall alone hatch. The most remarkable point connected with this egg-breaking business is that the spreos or other hosts should continue to sit. Their parasitic habits being apparently well known, the honey-guides are in most cases fiercely attacked by the owners of the nests visited, and in some cases the resistance prevents the intruders from breaking the original eggs. In such instances the young honey-guides probably eject their fellow nestlings, and it is noteworthy that the beaks of the former are furnished with powerful hooks, which disappear in the adult. This, it is conjectured, is a provision to assist them in ejecting the other occupants of the nest. It has also been noticed that a young honey-guide

SPARRMANN'S HONEY-GUIDE.

taken from the nest of a diamond-sparrow (*Petronia petronella*) was very large for its age; here again exhibiting a cuckoo-like feature. The mention of a single nestling in this instance suggests that the honey-guides lay only one egg in a nest. As *Indicator* is common to Africa, Malaya and the Himalaya, it would be interesting to ascertain if the parasitic habits of the African species are shared by their Asiatic cousins; but as the Himalayan bird is believed to lack the "honey-guiding" habit of the South African species, it may also differ in the matter

HELMETED TURACO.

of egg-laying. Honey-guides, of which *I. sparrmanni* (or *indicator*) is a well-known species, are usually black, relieved to a greater or less extent by yellow.

The family of trogons (*Trogonidæ*) is largely tropical American, but Africa has representatives in the shape of the exclusively Ethiopian genus *Hapaloderma*, of which *H. narina* ranges from north-east Africa to Cape Colony and Angola, while *H. constantia* is west and *H.* (*Heterotrogon*) *vittatum* east African. Like so many other members of the family, these birds have much green in the plumage.

WHITE-EARED MOUSE-BIRD.

An exclusively African group are the handsome golden cuckoos, among which *Chrysococcyx* (*Metallococcyx*) *smaragdineus* is emerald-green with a golden breast and white-barred tail, while *C. cupreus* is coppery green and white above and bronze and white below. The white eggs are laid in the nests of finches and sun-birds.

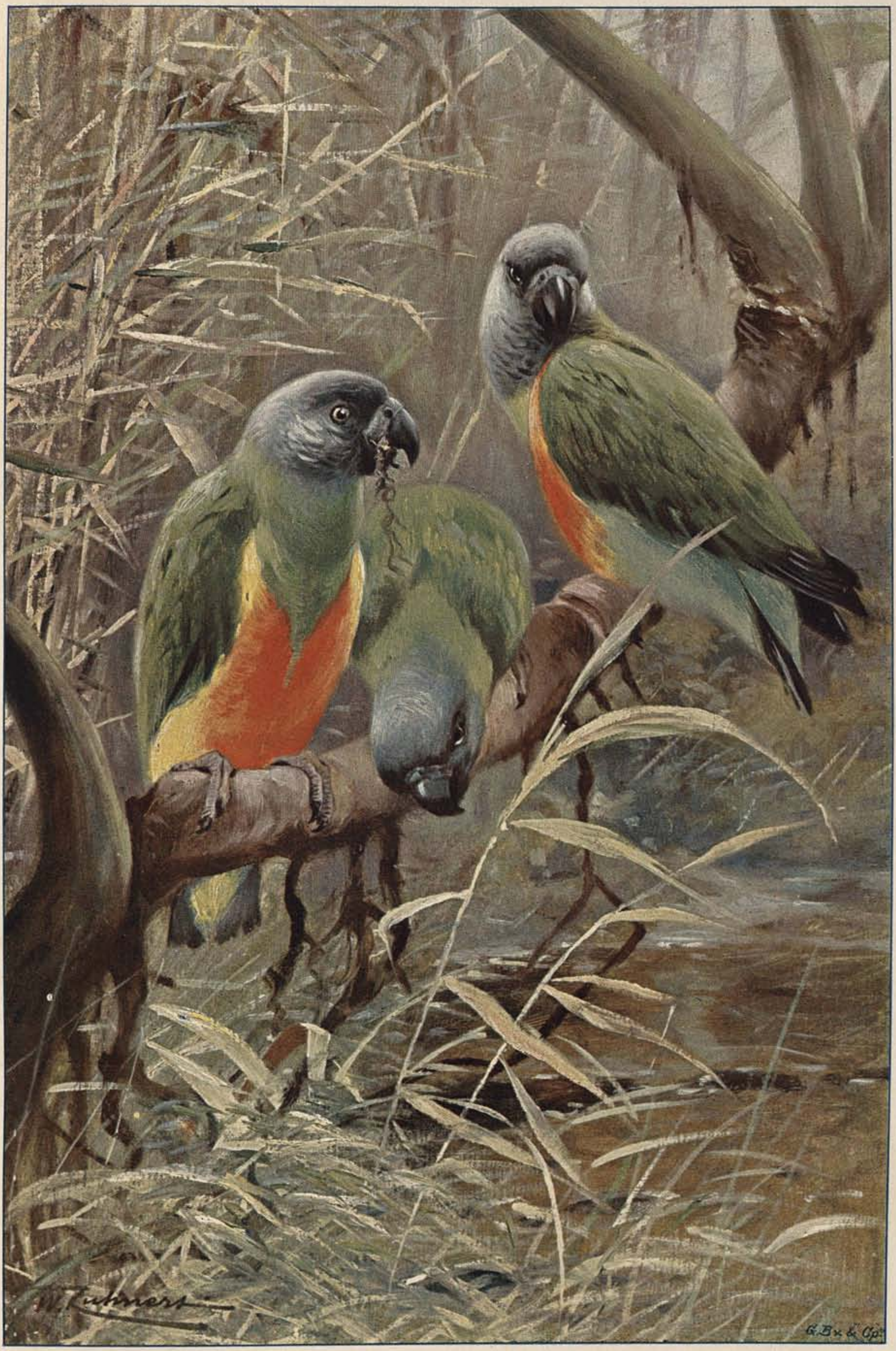
The plantain-eaters of the family *Musophagidæ*, which differ from the members of the allied groups by the reversible outer toe, have six or seven generic types, with a considerable number of species, restricted to Africa. These birds dwell in the tree-tops, where they consort in small flocks and feed on insects and berries. With the exception of the species known as the turaco, which frequents low bush, they lead a secluded life, seldom coming to the ground, and betraying their presence only by their loud, musical call. Eleven of the species are remarkable for their brilliant green plumage, the stout, laterally compressed and sharply ridged beak, and the stiff feathers around the nostrils. A species peculiar to tropical West Africa is the helmeted turaco (*Turacus buffoni*), which is more or less green on the wings and the lower part of the back, and dark violet on the rump and tail, the under-parts being dark green, wing-coverts purplish red, and the sides of the head marked by longitudinal stripes of black and white with bare reddish rings round the eyes. The genus *Schizorhis* includes about a dozen species distinguished from other plantain-eaters by the colour of their plumage, and the slight compression of the beak, which has an arched ridge, with the slit-shaped nostrils placed near its base. A well-known member of the group is the handsome *S. africana*, of Senegambia and the Gold Coast. The genus *Gallirex*, which may be regarded as intermediate between the two last, comprises a couple of species distinguished by the shape of the beak and the oval nostrils, as well as by the striking plumage, in which green predominates. In this group the South African *G. porphyreolophus*, characterised by its glossy violet hood, is about the size of a jackdaw. The typical plantain-eaters, on the other hand, are distinguished by the beak being somewhat flattened at the base, with the ridge widening into a small flat plate on the forehead, the presence of a bare ring round the eyes, and the blue plumage. The violet plantain-eater (*Musophaga violacea*) of tropical West Africa, which may also be compared in size to a jackdaw, has glossy dark blue plumage, dark carmine velvety feathers on the head, and a narrow white stripe below the bare space round the eye. Largest of all is the giant turaco (*Corythæola cristata*), which is about the size of a pheasant, and the only species of its genus. This bird is for the most part light blue with a black hood or crest, green breast, chestnut-coloured legs, belly, and rump, and a tail blue at the root and margined at the tip with blue, the middle of the outer feathers showing a broad olive-yellow transverse stripe. The beak is sharply ridged and laterally compressed, with round nostrils, and the region round the eye bare.

The mouse-birds or colies of the exclusively African family *Coliidæ* include a number of climbing species of the approximate size of finches characterised by the crested head, the short conical, curved beak, and the very long and graduated tail. These birds, which feed on fruits and buds, associate on tree-tops or among tangled creepers in small flocks, creeping and hanging in strange postures very much after the manner of titmice. The South African coly (*Colius striatus*) is an almost uniformly brown bird with a reddish forehead, while the white-headed *C. capensis* is distinguished by a black-edged white stripe on the back and a red eye-ring. *C. erythromelon* has likewise a red eye-ring, and the head marked with buff. In *C. macrurus* the eye-ring is red and the nape blue, and *C. castanotus* has the lower part of the back maroon and lacks a white stripe. The black throat and forehead are distinctive of *C. nigricollis*, as is the white head of *C. leucocephalus*, and the white ear-coverts of *C. leucotis*, the white-eared mouse-bird.

Parrots. In spite of the fact that it is the home of the typical representative of the whole group, Africa is but poorly off for parrots, *Psittacidæ*. The blunt-tailed group, is, however, exclusively confined to that portion of the continent lying south of the Sahara. These parrots are characterised by the shortness of the lower half of the beak, and the abbreviated tail, which is only half as long as the wings. Several of the numerous species inhabit the Gabun and other parts of the west coast; the black-headed parrot (*Pœocephalus senegalus*) is a well-known Senegambian bird, which is replaced in East Africa by the brown-headed *P. fuscicapillus*, while Levaillant's parrot (*P. robustus*) is South African. The grey parrots are likewise exclusively African, with near relatives in the vasa parrots (*Coracopsis*) of Madagascar and the Comoro and Seychelle Isles, the other member of the group, the black parrot (*Dasyptilus pesqueti*), being Papuan. Grey parrots are by no means strong flyers, although expert climbers, and spend most of their time in trees. They are social birds only in the breeding-season, keeping at other times apart from one another; they feed chiefly on stone-fruits and berries, but will sometimes make raids into plantations of young maize and rice. The typical grey parrots may be recognised by the long, compressed beak, the short, square tail, half as long as the wings, and the general presence of bare patches on the sides of the head. To this group belongs the ordinary grey parrot (*Psittacus erithacus*), the typical representative of the entire order, and a native of West and Central Africa. When once tamed, this familiar bird adapts itself better than other species to a life in captivity. The general colour of the plumage is grey, darker in the young than in the adult, but the tail is red, the naked face whitish, the beak black, and the eyes brown in young birds up to the third year, but afterwards yellow. In Liberia and Senegal this species is replaced by the Timneh parrot (*P. timneh*), a smaller bird with a wine-red tail, and the ridge and base of the upper half of the beak pale flesh-colour. The love-birds form a group of small parrots scarcely larger than sparrows, with very short rounded tails and green plumage, restricted to Ethiopian Africa and Madagascar. The typical love-bird (*Agapornis pullaria*), which is common to West and East Africa, is green in colour, with an orange-red face, whereas in the rosy love-bird (*A. roseicollis*) of South-west Africa the colour is green above and yellowish beneath, with a red forehead, rosy cheeks and throat, and blue rump and median tail-feathers, the other feathers of the tail being red with blue tips. The Indian ring-necked parraquet (*Palæornis torquatus*) is known to have flown ashore from ships anchored in Table Bay, and has now established itself over a considerable part of South Africa, and from this fact it has been suggested that the parraquet now found in Central Africa originally reached the country in the same manner. This equatorial parraquet differs, however, from the typical Indian bird by the shorter wings and slighter beak, and is accordingly regarded by some naturalists as a distinct species, under the name of *P. docilis*.

Owls.

Among the owls of Ethiopian Africa, special mention may be made of Pel's fish-owl (*Scotopelia peli*), whose range extends across the continent from the Gabun to Nyasaland, as the typical representative of a genus with three other species confined to the region under consideration. In addition to its bare legs and brown eyes, this owl is characterised by the dark brown bars on the rufous upper-parts and the dark blotches on the fawn-coloured under surface. The other three species are West African. The eared owls are distributed over nearly the whole of Africa, the Cape species (*Asio capensis*) ranging into southern Spain as well as Arabia and Madagascar. The white-eared owl (*A. leucotis*), on the other hand, is confined to Africa. In another group the pale eagle-owl (*Bubo lacteus*) is unknown on the west coast, where its place is taken by *B. shelleyi*, *B. leucostictus*, and two other species; while the spotted eagle-



SENEGAL PARROT.

owl (*B. maculosus*), distinguished by the round white spots on the upper part of the body, is confined to southern Africa.

Diurnal Birds-of-prey.

The falcons are represented in South Africa by the red-headed *Falco biarmicus*, a species about the size of a peregrine, distinguished by the slight development of spots on the under surface. The black Cape eagle (*Aquila verreauxi*) ranges northwards into Abyssinia, while the tawny eagle (*A. rapax*), distinguishable by the brown and rufous feathers of the upper-parts, is found over the greater part of the continent. The former species constructs its nest in Cape Colony entirely of the green boughs of a rough bush, which must be very difficult to break off. The only other instance of the use of similar material for nest-making occurs in the case of another African species, *A. wahlbergi*, where it is used as lining. *A. verreauxi* preys, to a great extent, on hyraxes, numerous remains of which have been found in its nests, but also hunts and kills a certain number of klipspringers. A very characteristic African bird is the short-tailed bateleur eagle (*Helotarsus ecaudatus*), ranging all over the continent south of the Sahara and common in many districts, but preferring the mountains to the plains, and open country to forest. The nest, however, is generally placed in high trees, the branches of which are thickly set with thorns. Snakes constitute the chief food of these eagles, which also eat lizards, small mammals, such as young antelopes, lambs, and most probably also carrion. They kill and eat both poisonous and harmless serpents, striking them swiftly with a stroke on the head. When the grass of the African veldt is on fire the bateleur eagles and other serpent-eaters follow the line of fire in order to seize the fleeing reptiles amid the dense smoke. At night bateleurs retire to trees to roost, coming forth again at dawn to hunt for food, but reposing during the heat of the day. In covering the distance between their roosting-places and their hunting-grounds these fine birds fly at a height of some 200 feet above the ground, their superb flight, more like that of a vulture than of an eagle, making them no less conspicuous than does the contrast between the white on the under side of the wings and the black of the body. In East and North-east Africa is found the creamy-backed species known as the black-winged bateleur (*H. leuconotus*).

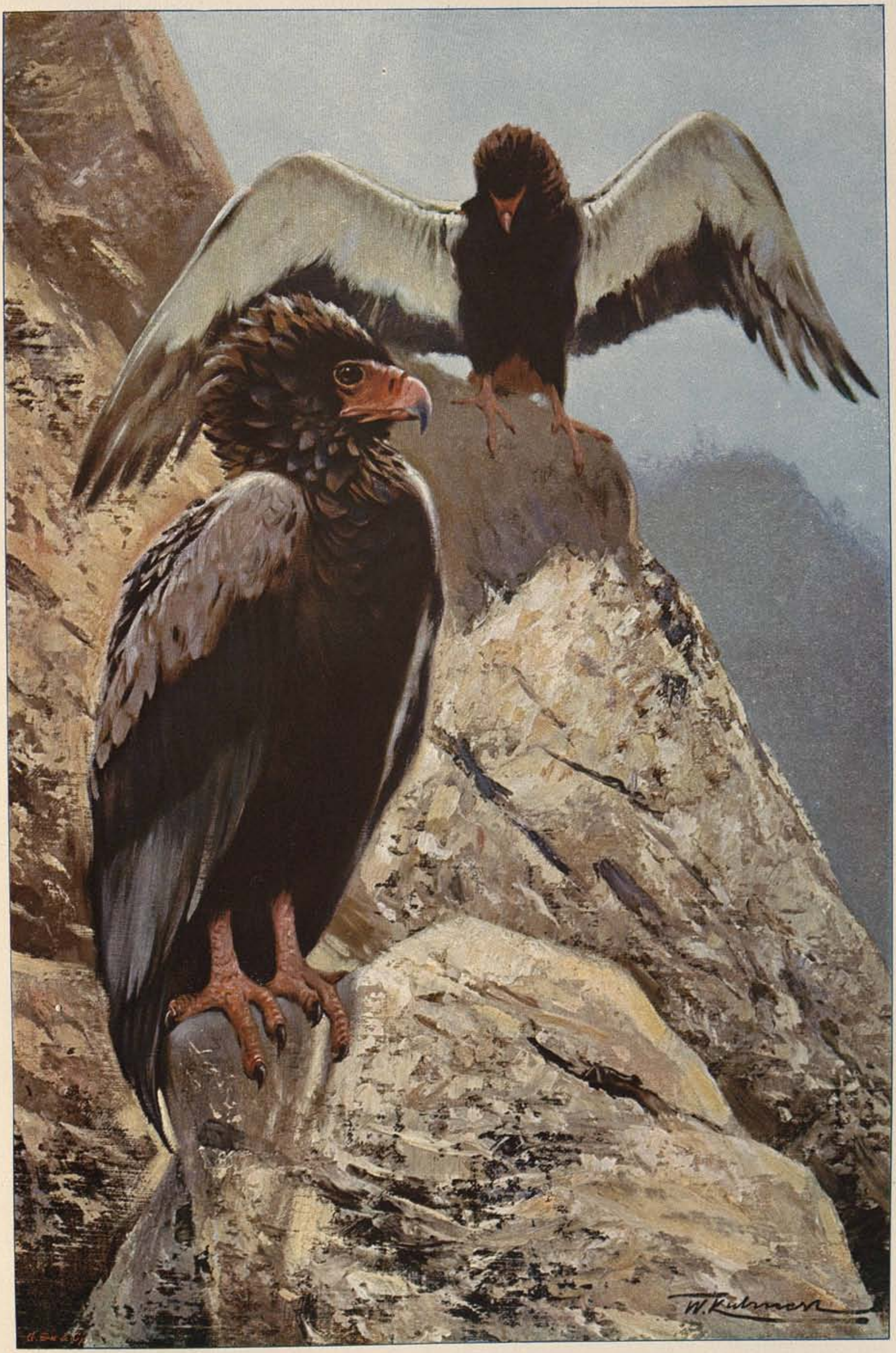
The African sea-eagle (*Haliaëtus vocifer*), which ranges over the continent, is distinguished by the white head and shoulders, white breast and tail, and chestnut under-parts. Representing a genus by itself, the Angola sea-eagle (*Gypohierax angolensis*) is characterised by the bare space round the mouth and eyes, and the long beak. In colour it is mostly white, with the exception of the scapulars, primaries, secondaries, and the bases of the tail-feathers, which are black. This bird is common on the west coast, but rare in South and East Africa. The handsome crested eagles are represented in the Ethiopian region by the crowned eagle (*Spizaëtus coronatus*), the tufted eagle (*S. occipitalis*), and the fighting-eagle (*S. bellicosus*). Of the bare-cheeked hawks, which are common to Africa and Madagascar, the African *Polyboroides typicus*, locally known as the serpent sparrow-hawk, is grey in general colour, with white tips to the black wing and tail-feathers, and the lower part of the breast barred with black and white. The Malagasy *P. radiatus*, on the other hand, is of a more silvery tone of colour

Both species have the power of bending the upper joint of the shank of the leg either backwards or forwards, a peculiarity of great assistance to these birds when engaged in drawing frogs or lizards from their hiding-places.

In the vulture group the African lammergeier (*Gypaëtus ossifragus*) differs from the European *G. barbatus* in having the lower portion of the legs bare. As now restricted, the typical genus *Vultur* has no Ethiopian representative; but of the allied genus *Gyps*, *G. fulvus* is a native of the Sudan, while *G. rueppelli* has a wide range in the region, and *G. kolbi* is peculiar to South Africa. The tropical *Pseudogyps africanus* is the Ethiopian representative of a genus whose other member is Indian, the same being the case with *Otogyps auricularis*. On the other hand, *Lophogyps occipitalis*, of the equatorial regions, is the sole representative of its genus. The two Ethiopian scavenger-vultures have been separated, perhaps unnecessarily, from the typical North African and Indian *Neophron* under the names of *Necrosyrtes pileatus* and *N. monachus*.

SERPENT SPARROW-HAWK

Of all the Ethiopian birds-of-prey none is more characteristic and aberrant than the well-known secretary-bird (*Serpentarius secretarius*), the only representative now living of the family *Serpentariidæ*. This remarkable bird is easily recognised by its long, wader-like legs, short and slightly curved claws, very short toes, and greatly elongated and graduated tail, in which the two middle quills are prolonged far beyond the others. The name of the species is derived from the plume of long feathers on the nape of the neck, which stick out behind the head in a fashion suggestive of the quill pens formerly carried by clerks in a somewhat similar position. Secretary-birds are most common on the plains of southern Africa, although their range extends as far north as Senegambia, the Sudan, and Abyssinia. These birds apparently subsist on a mixed diet, of which reptiles form a not inconsiderable portion, and spend most of their time on the ground, from which they do not rise even when pursued by horsemen, but



Bateleur Eagle.

continue to run till they fall from exhaustion. Nevertheless, they are strong, although somewhat heavy flyers, and may often be seen circling with outstretched wings high in the air, when they may be recognised by their long necks and legs. Indeed, they are not sufficiently terrestrial in habit to lay their eggs on the ground,

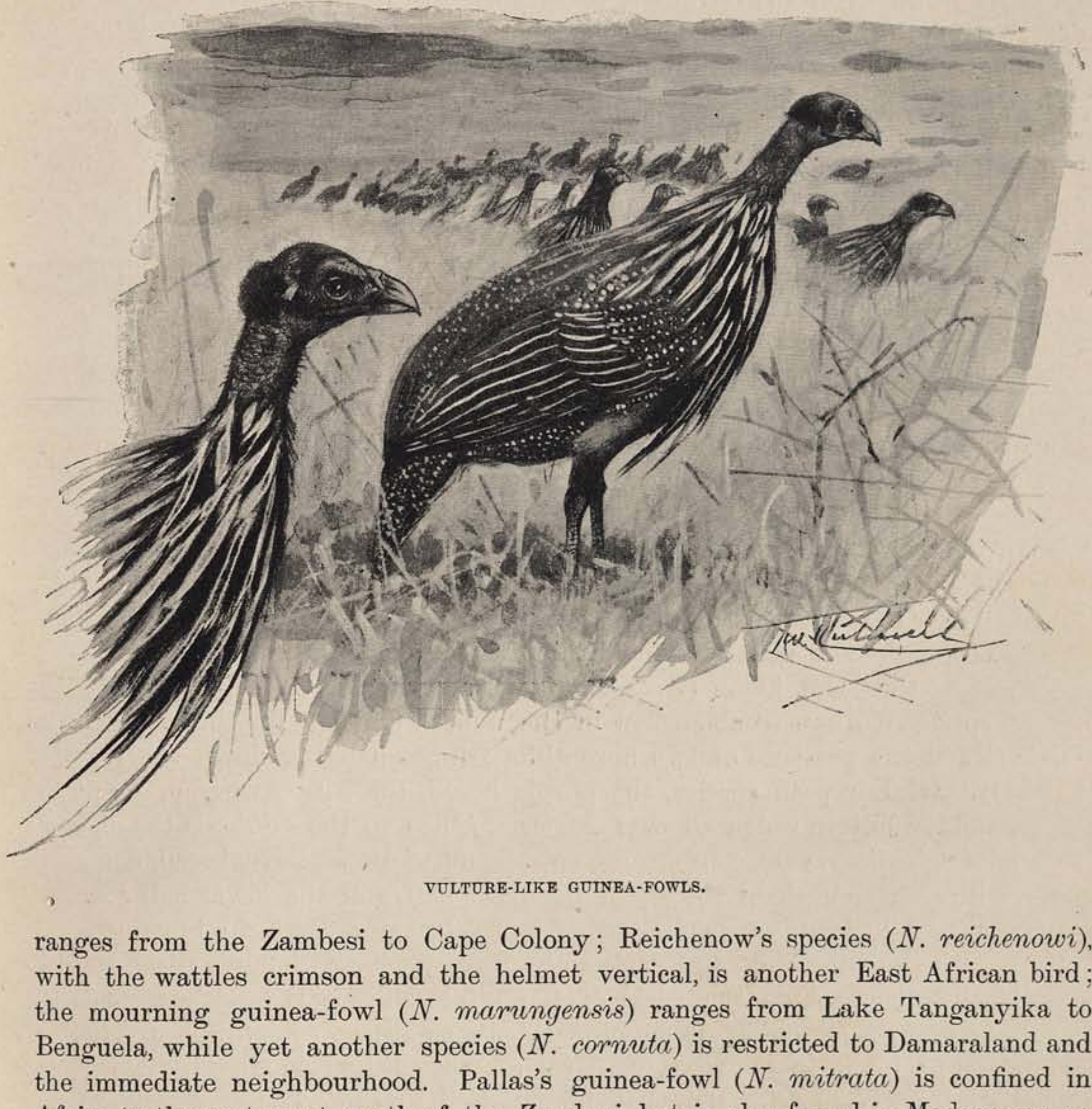
PILEATED SCAVENGER-VULTURE.

but build their nests of clay and mud on high bushes or mimosas. In size the secretary-bird resembles a crane, while in colour it is uniformly grey, with black on the neck and wings, and the plume mingled black and grey. The pairing-season takes place in June or July, and in August the female lays three or four pure white or speckled eggs about the size of those of a goose, which require a period of six weeks before the young are hatched, during which time the male regularly feeds the female. The young remain helpless for about five or six months, sometimes even longer.

Game-birds. The game-birds of Ethiopia include several kinds of francolin, together with the guinea-fowls (*Numididæ*), which, unlike the former, are exclusively confined to the African continent. Among the francolins, which are members of the pheasant family, the widely spread genus *Francolinus* has a number of Ethiopian species, such as *F. coqui* of the Cape, *F. schlegeli* of the equatorial region, *F. kirki* and *F. granti* of East Africa, *F. gutturalis* of Abyssinia and Somaliland, and *F. albigularis* of Senegambia. This genus also occurs in India, but *Pternistes*, with several, and *Ptilopachys*, with one species, are solely African. Among the *Numididæ* the common guinea-fowl (*Numida meleagris*), of the west coast from Senegambia to the Gabun, is the original stock of the domesticated bird, and has been acclimatised in the West Indies and elsewhere. It has the well-known black and white spotted plumage, but the upper part of the body is marked with

SECRETARY-BIRD.

a fine network of white lines, the neck is plain vinous grey, the sides of the jaw and neck are bare, and the chin and wattles red. Closely allied, but rather smaller, is the Abyssinian guinea-fowl (*N. ptilorhynchus*), so called from the tuft of horny bristles over the nostrils. This East African species is met with both in bush and in forests, and in summer, when running on grass, has the habit of flapping its wings in much the same way as a quail. In the evening it shelters on trees, and in the villages of Sennar may often be seen in close vicinity to human dwellings roosting on the acacias and cypresses, when unmolested by the natives. The larger helmeted guinea-fowl (*N. coronata*), distinguished by the pale blue wattles with a red tip, ranges from the Zambesi to Cape Colony; Reichenow's species (*N. reichenowi*), with the wattles crimson and the helmet vertical, is another East African bird; the mourning guinea-fowl (*N. marungensis*) ranges from Lake Tanganyika to Benguela, while yet another species (*N. cornuta*) is restricted to Damaraland and the immediate neighbourhood. Pallas's guinea-fowl (*N. mitrata*) is confined in Africa to the east coast north of the Zambesi, but is also found in Madagascar, as well as in the Comoro Islands and Rodriguez, where, however, it appears to have been introduced. The most beautiful member of the whole group is the vulture-like guinea-fowl (*Acryllium vulturinum*) of East Africa, characterised by the naked throat and head and the velvety plumage, ornamented with a band of



VULTURE-LIKE GUINEA-FOWLS.

reddish brown on the neck and a white stripe on the long blue-edged black hackles, the rest of the body being black with white wavy lines and small, round, white spots. The rare black guinea-fowl (*Phasidus niger*), of the west coast from Cape Lopez to Loango, the only species of its genus, is blackish brown mottled with dark brown, the bare head and neck being yellow. The turkey-like guinea-fowl (*Agelastes meleagroides*), also the sole representative of its genus, is a western species, ranging from Liberia to the Gabun. With a white chest and upper-parts, it has the naked areas bright red.

In the plover tribe (*Charadriidæ*) it must suffice to refer to that handsome bird, the painted snipe (*Rostratula*, or *Rhynchœa, capensis*), which is markedly distinct from the true snipe, and is common to Africa and India. The large buff spots on the tail-feathers afford unmistakable means of recognising these birds.

A similar brief notice must suffice in the case of the rails (*Rallidæ*), of which perhaps the most notable Ethiopian representative is the West African bush-rail (*Himantornis hæmatopus*), a bird with a rather short body, a black and green curved beak, and comparatively long legs. It is the only representative of its genus.

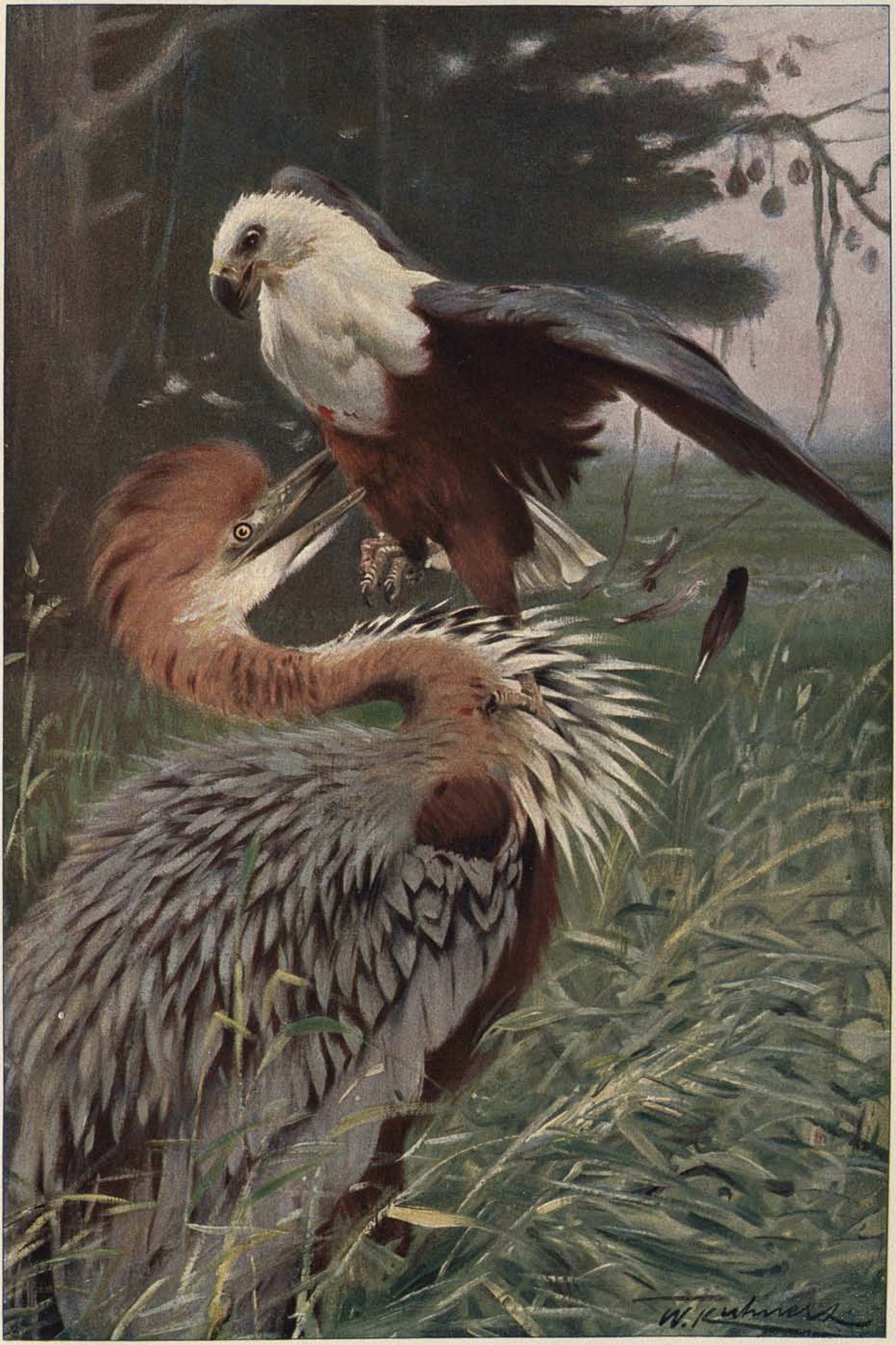
Pigeons.

Neither can much space be accorded to the pigeon group (*Columbidæ*), although reference must be made to three exclusively Ethiopian genera. Of these, *Vinago*, with some half-dozen species, ranges from Abyssinia to Cape Colony; *Turturæna* includes species in which the plumage of the two sexes is unlike in colour; and *Haplopelia* is represented by the so-called cinnamon-doves, which subsist chiefly on berries picked up from the ground, whereas the species of *Turturæna* are stated to feed principally on the larvæ of cicadas.

In addition to the above, mention may be made of the African ground-dove (*Chalcopelia afra*) and the Senegal turtle-dove (*Turtur senegalensis*), both of which range all over the continent, and the latter also reaching the Canaries.

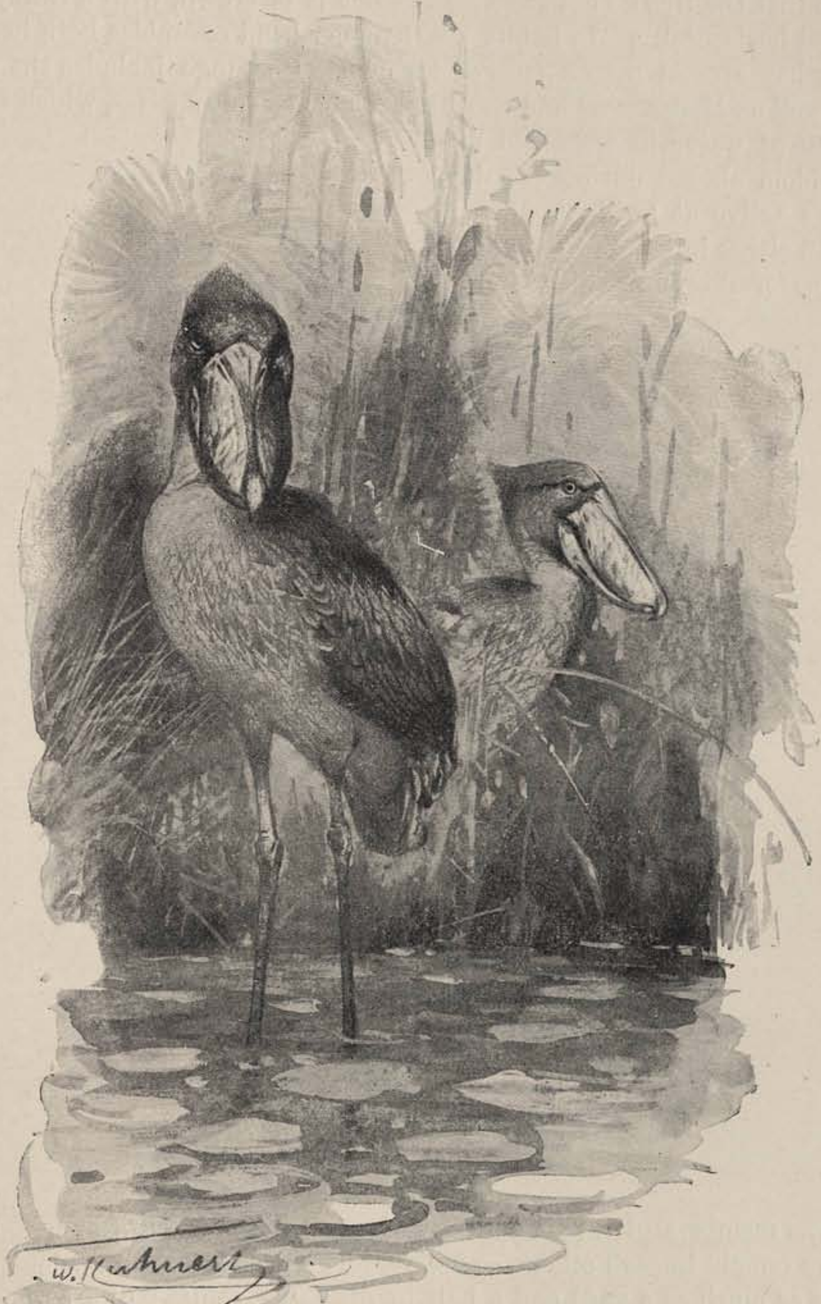
Herons and Storks.

The most striking Ethiopian member of the family *Ardeidæ* is the giant heron (*Ardea goliath*), a bird half as large again as the typical species, and remarkable when in the nuptial plumage for the beauty of its feathers and the presence of two apron-like fringes hanging down the front of the body. Of European species, the purple heron, the squacco heron, the night-heron, and the bittern range all over Africa. Allied to the storks is the gigantic shoe-bill (*Balæniceps rex*), conspicuous on account of its massive, broad, depressed beak, with a sharp hook at the tip of its upper half, and the lower half rounded. This stoutly built bird is about the size of a marabou stork, and of a brownish grey colour, with the wings and tail dark slaty grey, the beak cloudy yellow, and the feet black. Confined to the basin of the White Nile, it is least uncommon in northern Equatoria. These birds feed chiefly on fishes, to capture which they will stand for hours in the water with their great beaks held close to the surface. Among other peculiarities, they are characterised by the presence of a large pair of powder-down patches on the lower part of the back, and the absence of such patches on the breast. At the pairing-season, which takes place during the rains, the nest is built by the side of the water, at a slight elevation above the reeds, and formed of a quantity of twigs and stems of water-plants mixed with mud, the



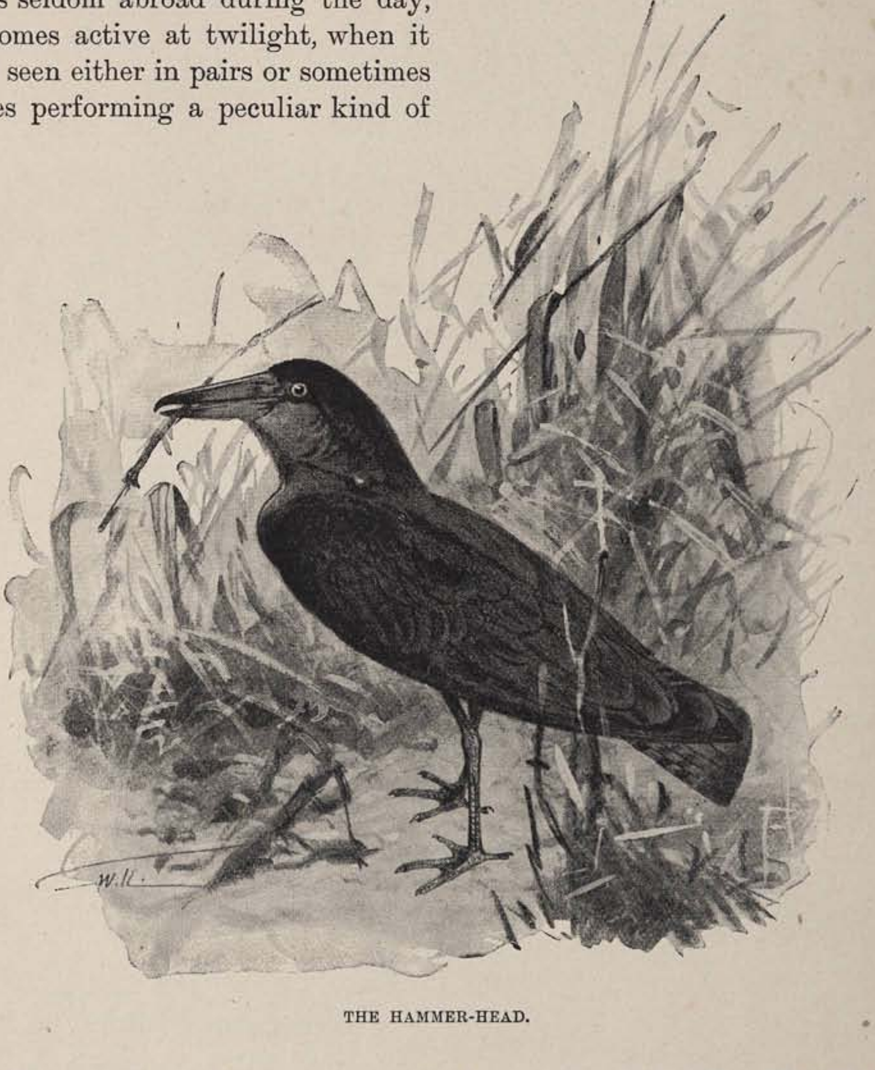
GIANT HERON AND SEA EAGLE.

walls being about a yard high. In this huge structure are laid the eggs, which are comparatively small and bluish white in colour overlain with a chalky layer, the blue changing to brown as incubation proceeds. Another remarkable type is the hammer-head (*Scopus umbretta*), which, like the shoe-bill, is the only represent-

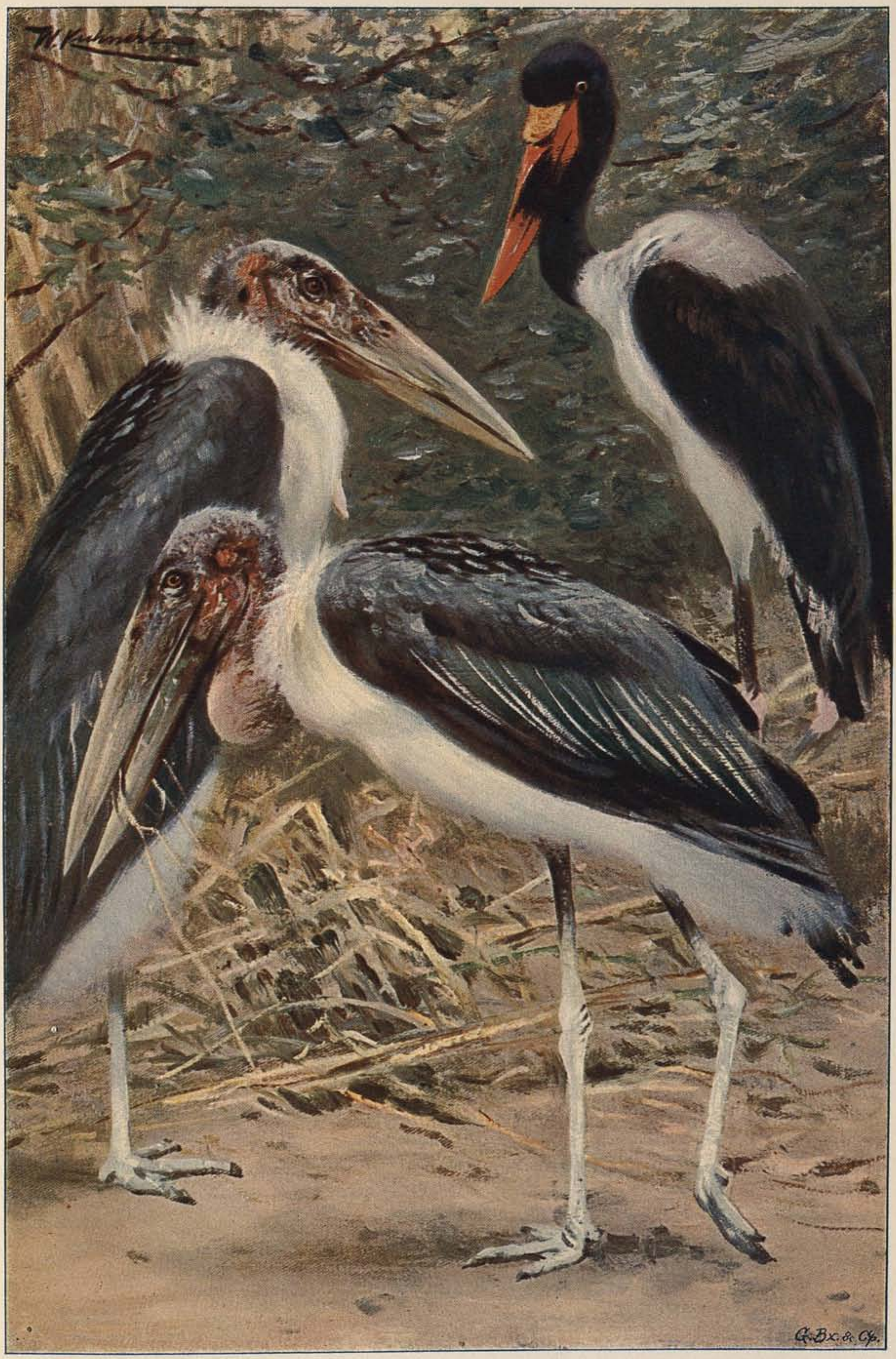


THE SHOE-BILL.

ative of its genus, and appears to be nearly related to the storks. This bird is chiefly characterised by the much compressed beak, which has a strongly developed ridge and sharp cutting-edges, the upper half being hooked and the lower half rounded so that the tips do not close. In colour it is brown, with a heavy erectile crest carried horizontally. In habits the hammer-head resembles both herons and storks, but has several peculiarities of its own. Its range includes the whole of Africa, as well as Madagascar and southern Arabia. This species, which frequents the vicinity of water in woodland districts, is seldom abroad during the day, but becomes active at twilight, when it may be seen either in pairs or sometimes in threes performing a peculiar kind of dance. The members of a pair appear to be associated for life, although they do not always remain in each other's company. The nest is a most curious structure, sometimes as much as a yard and a half in diameter, vaulted like a dome, and so firmly made of sticks that a man can stand upon the roof without breaking through. As a rule, it is placed in the fork of a tree near the ground, but sometimes in the fissure of a rock, with an entrance on the side most concealed. Internally it consists of three chambers, accessible only by a small hole large enough to admit the bird, the upper compartment serving as a sleeping-chamber,



THE HAMMER-HEAD.



MARABOU AND JABIRU.

in which are laid the eggs, three to five in number. These are incubated alternately by each parent; and when the young become too large for the upper one they are transferred to the middle chamber, the lower compartment being then used as a kind of sentinel-box.

Another member of the group is the Abdim stork (*Abdimia sphenorhyncha*), of which the plumage is brownish black above and white below, while the shortness of the legs distinguishes it from other storks. The jabiru storks (*Xenorhynchus*) and the marabou storks or adjutants (*Leptoptilus*) are well represented in Ethiopian Africa, as are likewise spoonbills and ibises. In the former group the white spoonbill (*Platalea alba*) is restricted to tropical Africa and Madagascar; while in the latter three genera, each represented by a single species, namely, the South African *Geronticus calvus*, the equatorial *Hagidashia hagedash*, and the West African *Lampribis rara*, are exclusively Ethiopian.

Cranes. Among the cranes, or *Gruidæ*, the crowned cranes (*Balearica*) are exclusively Ethiopian, and are represented by the typical crowned crane (*B. pavonina*), ranging from West to North-east and Equatorial Africa, the South African Kafir crane (*B. chrysopelargus* or *regulorum*), which extends as far north as the Zambesi, and the East African *B. gibbericeps*.

The Stanley crane (*Grus* [*Tetrapteryx*] *paradisea*) represents by itself a subgenus, or genus, confined to southern Africa, and distinguished by the long primaries and lancet-shaped throat-feathers, the crown of the head being white. A second subgeneric type, with this one species, is formed by the great wattled crane (*G.* [*Bugeranus*] *carunculata*), characterised by having a pair of feathered flaps of skin pendant from the chin, the upper-parts being grey with white on the sides of the head, and the whole of the throat and under-parts black. The range of this species extends from South Africa along the east coast to Shoa and Somaliland.

Bustards. In the bustard family (*Otididæ*) the genera *Otis* and *Tetrax* are unrepresented in Ethiopian Africa, but *Eupodotis*, already referred to in Chapter I., extends to East and South Africa, where the great kori bustard (*E. cori*), the *ghaum-paauw*—*i.e.* gum-peacock—of the Boers, is still sometimes met with on the karu-velt to the south of the Orange River, and in Northern Cape Colony, but is abundant in the Transvaal, Bechuanaland, and Damaraland, whence its range extends northwards to the Zambesi. The large, backwardly directed tufts of black-tipped feathers on the head, together with its large size, render this magnificent bird recognisable at a glance. It takes its Boer name from its partiality for the gum which flows from many of the species of acacias, but it is almost omnivorous, feeding on locusts, beetles, lizards, small snakes, and seeds. As a rule, it associates in pairs, and frequents the bare, open plains, where it feeds in the mornings and evenings, reposing during the heat of the day beneath the shade of a bush. In weight it ranges from 20 to 30 or even 50 pounds. It is extremely shy and wary, and therefore very difficult to stalk, but is most easily approached when taking its midday rest. The genus *Eupodotis* includes five species, of which the collective range embraces Africa, India, and Australia.

Six genera of bustards, namely *Lophotis*, *Compsotis*, *Heterotetrax*, *Neotis*, *Lissotis*, and *Trachelotis*, are exclusively Ethiopian; the first two being represented by a couple of species, while the others have more. Well-known species are

Ludwig's bustard (*Neotis ludwigi*), the Stanley bustard (*N. caffra*), the black khoorhan (*Compsotis afra*), Rüppell's bustard (*Heterotetrax rueppelli*), the black-bellied khoorhan (*Lissotis melanogaster*), and the Senegal khoorhan (*Trachelotis cœrulescens*). The majority of the representatives of these six genera are natives of southern Africa, but the above-mentioned species of *Lissotis* is Senegambian, and there is a *Neotis* in Somaliland.

Several species of thicknees (*Œdicnemus*) are found in Africa, among which mention may be made of the dikkop or South African thicknee (*Œ. capensis*) and the Natal dikkop (*Œ. natalensis*). The former is a migratory species, ranging as far north as the tropic of Capricorn.

Geese and Ducks.

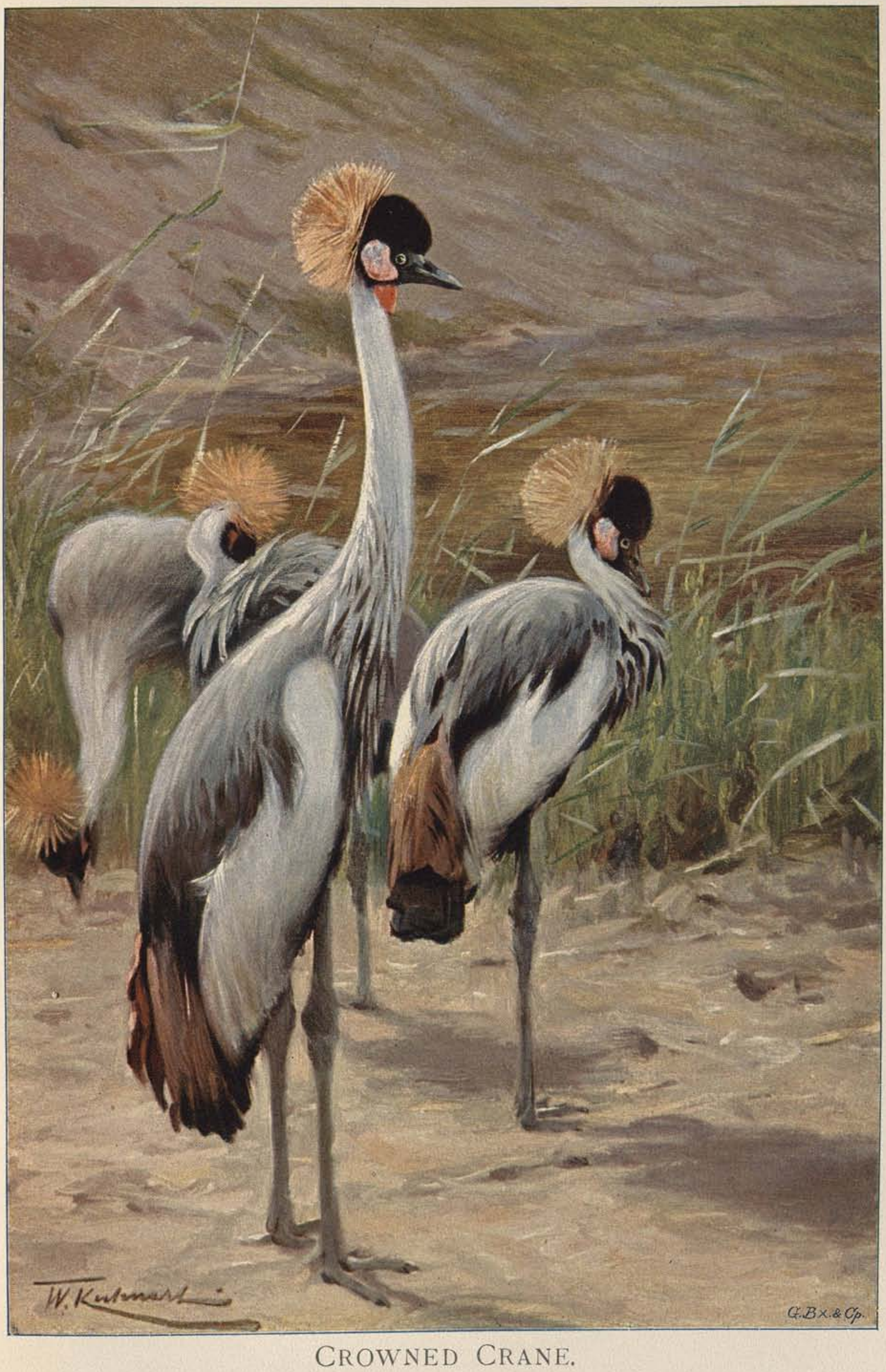
Some of the most remarkable of all water-fowl (*Anatidæ*) are the spur-winged geese of the genus *Plectropterus*, which are confined to Ethiopia, where they are represented by several species. These geese are characterised by the indented webs of the toes, the naked area round the eyes and on the forehead, and the presence of a long spur on each wing. The typical *P. gambensis* ranges from Senegambia to the Zambesi and the Transvaal, while Rüppell's spur-winged goose (*P. rueppelli*) is found in the north-east, the shoan (*P. shoanus*) in Abyssinia, and a fourth species, *P. niger*, on the south-east coasts. In colour these birds are mainly black and white. In the Sudan the typical species occurs in small flocks, which frequent during the greater part of the year the river-banks, but during the moulting-season, when they are unable to fly, take refuge in the reedy marshes and swamps. In the breeding-season they separate into pairs. To the south, where they lay more eggs than in the north, they occur in large numbers on the reedy banks of Lake Ngami, the Chobi, and the Zambesi; but when the water-courses and pools are full, they leave the swamps, and wander in pairs over the country, accompanied by their young. The large nest of reeds and rushes is generally built in a low bush or among reeds. These birds are nocturnal, feeding at night, and resting by day. The tree-ducks and comb-ducks are noteworthy on account of their peculiar distribution; one species of the former (*Dendrocycna viduata*), characterised by its white face, occurring not only in tropical Africa, but also in the tropics of America. The African species have a reddish tinge on the white of the face. The comb-ducks (*Sarcidiornis*) are common to Ethiopian Africa, India, and America.

Pelicans.

Brief mention may be made in this place of three other African aquatic birds, namely, the red-beaked pelican (*Pelecanus rufescens*), the white-throated cormorant (*Phalacrocorax lugubris*), and the African snake-bird (*Plotus levaillanti*), all of which have habits generally similar to those of their relatives in other parts of the world. Pelicans are known at the Cape by the name of duiker, the Dutch equivalent for diver.

Ostriches.

Last, but by no means least, come the ostriches, the largest and most powerful of all living birds, and the only ones in which the number of toes is reduced to two, of which the outer one is much the smaller. To describe in detail such a striking and familiar bird would obviously be out of place on the present occasion, but it may be remarked that the cock is much taller than the hen, standing over 8 feet, and when at speed covering 25 feet at a stride. There are at least four species, or races, among which may be specially mentioned

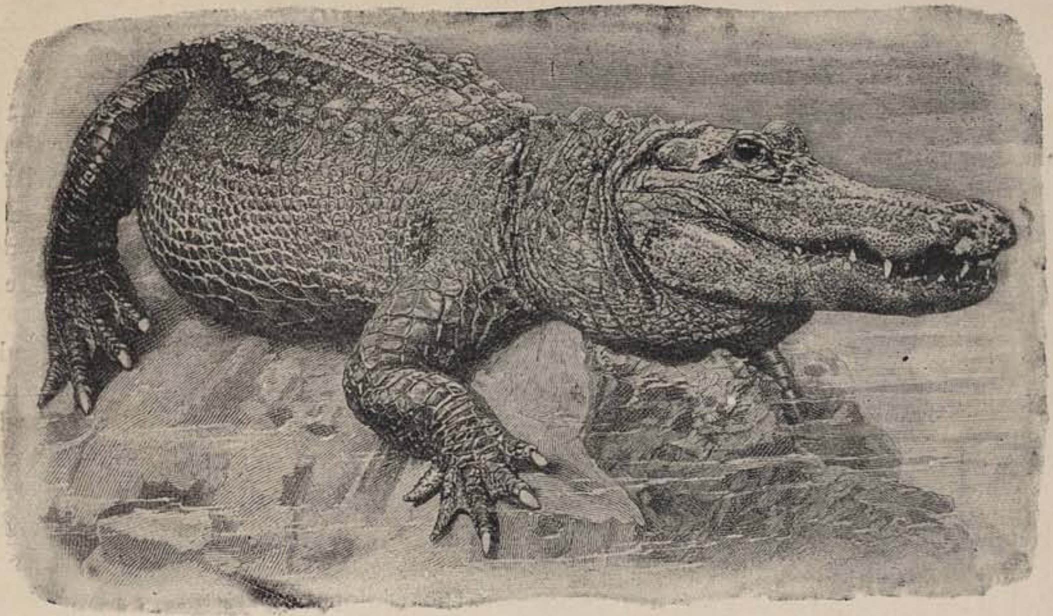


CROWNED CRANE.

the southern *Struthio australis*, characterised by the pinky red bare parts, and the Sudan *S. camelus* and the Somali *S. molybdophanes* in which they are leaden blue, the eggs of the two latter being smooth, while those of the former are pitted. The Somali bird ranges over northern Africa, and over Syria, Arabia, and Mesopotamia, where it has already become rare. The southern bird, on the other hand, is exclusively African, ranging southwards to the Cape, although exterminated in many districts where it was formerly abundant. Essentially inhabitants of open sandy country, ostriches in the south used to associate with the herds of gnus and zebras, and everywhere rival or outstrip even the swiftest of antelopes in point of speed. As is well known, these birds are able to go without water for long periods and never travel far to slake their thirst, although they seem always glad to drink and bathe when water happens to be near, and have often been noticed on the coast in the hot season standing up to their throats in the sea. Young birds are said to be mute, but the adult cocks utter a loud call, which has been compared to both the roaring of a lion and the lowing of an ox, and is generally heard in the early morning. Ostriches are generally regarded as polygamous; and it is usually stated that a number of hens lay their eggs in one nest formed in a hollow scooped out in the ground by a single male, but this is denied by a recent writer. A nest may contain as many as twenty eggs, a number of which are never hatched, but appear to be laid merely to serve as food for the young birds. In the cooler districts, where the sun cannot perform the process of incubation, the cock sits on the eggs throughout the night, only leaving them for a short period in search of food, but in the hotter regions they are merely covered with sand and left to hatch by themselves. According to an observer in South Africa, the old story of the ostrich hiding its head in the sand in order to escape from enemies has a basis of fact. It is well known that ostrich-chicks, like young thicknees, endeavour, when alarmed, to escape detection by lying flat on the ground, with the head and neck stretched out straight in front, where their mottled black and brown colouring causes them to harmonise in a marvellous degree with their surroundings. When approached and picked up, the crouching chicks will be found quite limp and motionless, and will not recover for some time, so that it seems we have to do with a true case of the death-feigning instinct. Adult ostriches, on the other hand, when danger approaches, usually seek safety in flight. Instances are, however, known where full-grown ostriches, instead of starting to run, have suddenly fallen to the ground, with outstretched head and neck, in a condition of apparent collapse. The sudden appearance of an enemy, as a man coming from the top of a kopje or from behind an ant-hill, is generally the inducing cause of such sudden collapses. In one instance, when an intruder came suddenly over a slight rise in open country, three ostriches about 400 yards distant suddenly dropped like stones, when they were almost indistinguishable among the surrounding ant-mounds. It is suggested that cases like these are to be attributed to a retention of the death-feigning instinct of the chick, which is generally in abeyance owing to the superior chance of safety the adult bird possesses in flight. Probably this occasional reappearance of the death-feigning instinct in the adult has given rise to the well-known, but generally discredited, story. Ostriches, it appears from the observations of the same naturalist, are in the habit of running off suddenly with a peculiar whirling movement, sometimes one way, sometimes another, simultaneously spreading their wings, which are alternately raised and depressed. These movements, it is suggested, may be connected with escape from the clutches of the large Carnivora. Indulged in instinctively as play while young, and even when adult, the performance gives the bird expertness in the rapid jerking movements which are those first followed on an alarm.

Migratory Birds. A number of species of migratory birds visit South Africa from the north during the southern summer, among which the following may be noticed. European swallows are to be met with at that season all over the veldt, although much remains to be learnt regarding the times of their arrival and departure. Eight species of cuckoo visit the country, among which the red-breasted *Cuculus solitarius* may be recognised by its loud triple note. On the other hand, the European cuckoo, which does not range so far south, is generally silent during its sojourn in Africa. Among the birds of prey are the Egyptian kite (*Milvus ægyptius*) and Naumann's kestrel (*Tinnunculus,* or *Cerchneis, naumanni*). Most interesting of all is the white stork, which begins to appear in South Africa in November. During the southern summer of 1910 it is recorded that in the Buffalo River district no less than 185 of these storks were observed one day in January to pass overhead in a quarter of an hour. They generally go northward again in March, although a few may linger till May. Black storks arrive earlier, sometimes making their appearance during the last few days of September.

In connection with storks, it may be mentioned that, as the result of marking the legs of nestlings, the occurrence of a south-westerly autumnal migration of these birds has been definitely ascertained, storks which were ringed in Denmark having been taken respectively at Brandenburg, near Frankfort-on-Oder, and in Austrian Silesia. This migration is remarkable in that its line cuts at right angles the route taken by the great majority of birds at the same season. As regards migration to and from Africa, Prussian storks have been captured in Syria, Palestine, and near Alexandria in some instances in the first, and in others in the second, year after marking. One Hungarian stork was also taken in Syria. On the other hand, three Prussian storks were severally taken during their first autumn near Lake Chad, on the Blue Nile, and on the Victoria Nyanza; a bird which left Pomerania at the end of August was taken in north-east Rhodesia early in December, and a Prussian stork was shot in the Kalahari during its first winter. There are also records of Prussian storks having been taken in the Transvaal, Natal, Basutoland, and the north of Cape Colony, and also of a dozen Hungarian birds from the same area, while one has been obtained so far west as German South-West Africa. With one exception, all these birds were taken during the northern winter; but the exception was captured in July. So far as the records admit of generalisation, it appears that storks generally return to their original summer haunts; but there is a notable exception in the case of a bird hatched near Brunswick in 1908, which made its appearance a couple of years later about 437 miles away in eastern Prussia. Very remarkable was the capture near Barcelona in September 1910 of a bird hatched in the neighbourhood of Cassel, as this west German stork took a line of flight almost exactly the opposite of that followed by its fellows hatched in Denmark and north-east Germany.



NILE CROCODILE.

CHAPTER V

SOME ETHIOPIAN REPTILES, FISHES, AND INVERTEBRATES

To give anything like an adequate account of the reptiles, frogs, fishes, and invertebrates of Ethiopian Africa would demand, at least, as much space as that contained in the whole of the present volume. In the present chapter all that can be attempted is a brief notice of a few—a very few—of some of the more interesting types.

Reptiles.

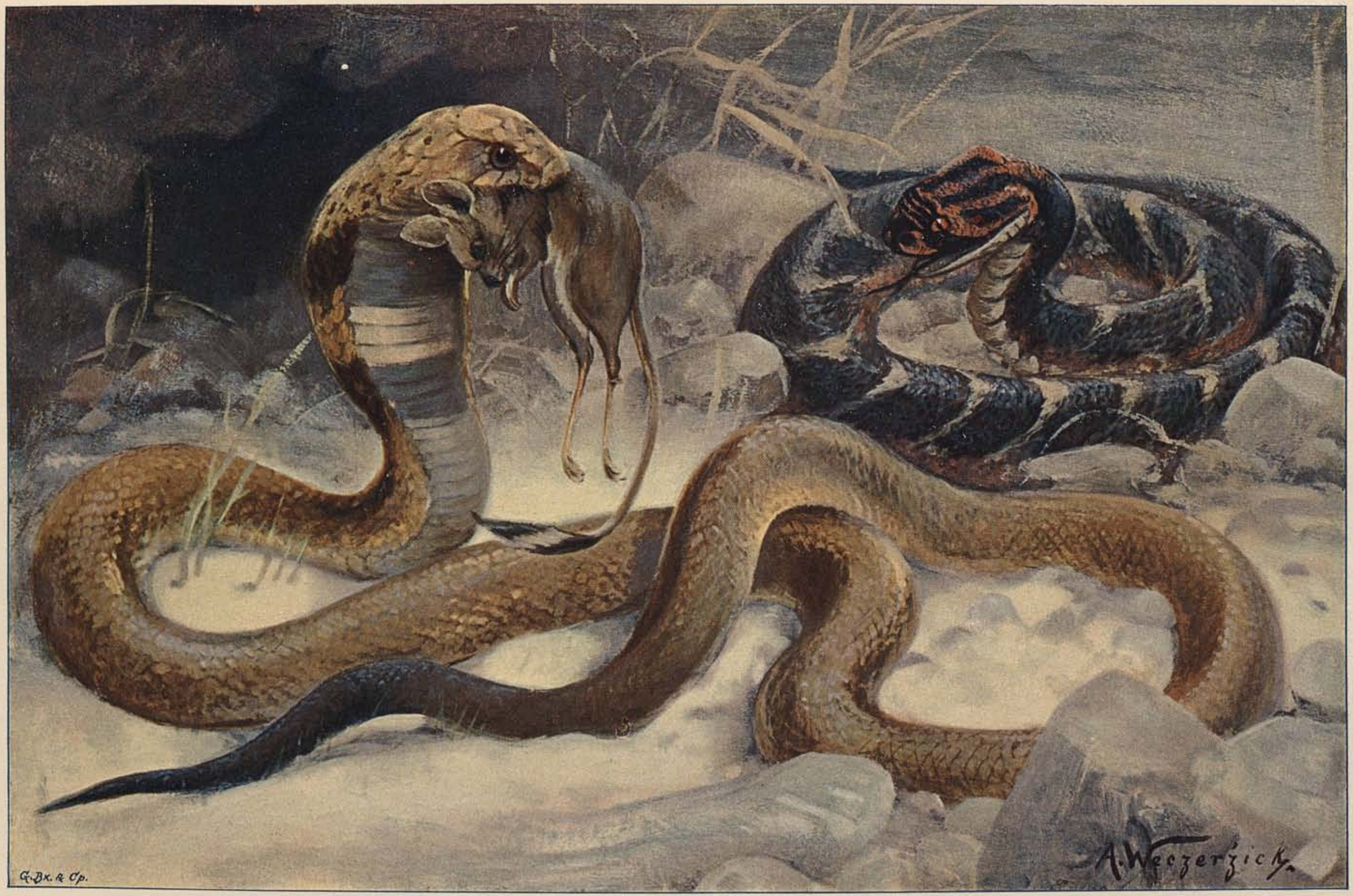
So far as the number of species is concerned, the Ethiopian region is by no means rich in reptiles. In addition to the Nile species, to which reference has been made in Chapter I., crocodiles are represented by the long-snouted *Crocodilus johnstoni* of the west coast, while a second and short-muzzled species from the same region is referred to a special genus, of which it is the only member, under the name of *Osteolæmus tetraspis*.

The largest African land-tortoise is the greaved *Testudo calcarata* of the Sudan and adjacent districts. In a specimen from the Sudan in the British Museum the upper shell measures 35 in. in length over the curve and 29 in. in a straight line. Seeing that this species grows to such large dimensions, it is not correct to state that living giant land-tortoises are confined to the Mascarene and Galapagos Islands. The African species differs, however, from those inhabiting these islands by its brown, instead of black, colour; this difference being due, no doubt, to its desert surroundings.

Very characteristic of southern Africa is the presence of a large number of species of land-tortoises, and among these many are characterised by the shell being raised into prominences or bosses from which radiate yellow lines on a black ground, forming patterns of varying complexity. *Testudo radiata* is a well-known example of this group. The allied genus *Homopus*, in which somewhat similar markings occur, is exclusively Ethiopian. As regards the evolution of the colour-pattern on the shells of South African land-tortoises, more especially those included in the genus *Homopus*, the following suggestion has been made: Starting with species in which each shield of the shell is of the normal horn-colour, the first stage is the development of a dark border, followed later by a dark centre. Next the whole shield becomes dark, excepting light lines radiating from the centre, after which the dark area may break up into spots or flecks.

In common with other parts of the Southern Hemisphere, equatorial and southern Africa is the home of several members of the group of side-necked, or pleurodiran, water-tortoises, that is to say, those which withdraw their head and neck by bending it to one side, instead of retracting it in a vertical plane by means of an S-like flexure. This group is unknown at the present day in the Northern Hemisphere. The two genera found in Africa, namely, *Sternothærus* and *Pelomedusa*, are common to the tropical and southern portion of that continent and Madagascar. Of the soft river-tortoises, the region possesses representatives of the widely spread typical genus *Trionyx*, and also two peculiar generic types *Cycloderma* and *Cyclanorbis*, confined to the tropics, where the first is represented by two and the second by a single species.

Africa is the home of a large number of more or less peculiar types of lizards, and from the distribution of these Mr. J. Hewitt has arrived at important conclusions with regard to the division of the continent into zoological provinces After mentioning that the Zambesi-Cuneni line does not form a natural zoological boundary, as there is an extensive overlap of the southern and tropical faunas, the author expresses the opinion that the southern districts of Africa possess a fauna sufficiently peculiar to entitle this area to be regarded as a distinct zoological region, divisible into several subregions. "As regards the entity of the South African region as a zoological area, there can be no doubt but that the distinction between the peculiar endemic fauna of southern Africa and tropical Africa is too pronounced to permit of our regarding the South African region as merely a province of the large Ethiopian area, and, indeed, but for the infiltration of tropical forms, no one would hesitate to unite South Africa with Madagascar as a region quite distinct from the more northern parts of Africa. But the question of the northern boundary of our area is quite another matter." Mr. Hewitt fully believes in the theory of a former land-connection between Australia, India, Madagascar, the Seychelles, and South Africa, which was sundered between Australia and Africa late in the Secondary epoch, and was elsewhere broken up into islands in the early Tertiary. The connection between Madagascar and India persisted until the Eocene, or perhaps later, as an archipelago, and Africa may have been connected by swamps with Madagascar until the early Pliocene or later Tertiary period. Another land-bridge connecting South Africa and South America by way of the Atlantic is likewise accepted. The fauna of the whole area is considered to have had many features in common; but after the separation of Madagascar and the formation of the African continent the latter area was invaded by a fauna from the north which could not reach Madagascar. The fauna of that island accordingly seems to represent in a modernised form—with a few



COBRA AND PUFF ADDER.

additions—the one originally common to the southern Ethiopian area. In attempting to explain the relations of the amphibian faunas of Africa, Madagascar, South America, and Australia, the author states that he is disinclined to accept the generic identity of the Malagasy boa-like snakes with South American types, and that he regards true frogs (*Rana*) as of African and tree-frogs (*Hylidæ*) as of South American origin.

Among lizards, special mention may be made of the girdle-tailed lizard (*Zonurus cordylus*) as representing a family—*Zonuridæ*—characterised by the presence of a fold along the sides of the body dividing the upper from the under parts. This family, which is restricted to South and East Africa and Madagascar, likewise includes the snake-like lizards constituting the genus *Chamæosaura*, in which the hind-legs are rudimentary and the fore-legs altogether wanting. The worm-like, burrowing lizards constituting the family *Amphisbænidæ* are likewise noteworthy on account of being common to Africa together with some of the countries of southern Europe and tropical America.

On the Gold Coast one of the commonest lizards is the spiny agama (*Agama colonorum*), a member of a widely spread Old World genus specially characterised by the brilliancy of its colouring. The markings are in red, yellow, and blue; and the length of this species is about sixteen inches.

Very characteristic of Ethiopian Africa is the great number of species of chamæleons, a group whose headquarters are in fact in this part of the world. Some of these Ethiopian species, such as the East African *Chamæleon fischeri*, are characterised by the presence of a curious appendage on the head.

In the serpent order certain burrowing snakes of the families *Typhlopidæ* and *Glauconiidæ* are to be met with in the area under consideration, but as these groups have a wide distribution, not much would be gained by further mention. Much the same remark applies to the pythons, of which the largest African species is *Python sebæ*. This species ranges from the equatorial to the southern districts of the continent, and grows to a length of between 11 and 20 feet.

Cobras are represented by *Naia haje*, ranging over the greater part of the continent, and known to the Boers as the *spy-slange*, as well as by the black *N. nigricollis* and other species. Another member of the same group is the *ring-hals*—banded neck—(*Sepedon hæmachates*), a species taking its name from the yellow or brownish bands on a black ground.

The most deadly of African snakes are, however, the puff-adders, typified by the widely spread *Bitis arietans*, which grows to a length of about 4 feet, and has a huge, ugly, flat head, and a brilliant type of colouring. For gorgeous colouring the palm is, however, taken by the nose-horned puff-adder (*B. nasicornis*) and the Gabun viper, or "river jack viper" (*B. gabonica*), of Equatorial Africa, in both of which yellow largely predominates. In common with certain other African snakes, the species last named is known to have the power of spitting out its venom to a considerable distance. According to a recent writer, this reptile when irritated can eject its poison to some distance, after the manner of the above-mentioned black cobra. One drop falling into a man's eye will cause burning pain, and sometimes produce serious effects. Dogs are often blinded by the ejected venom, especially that of the black cobra. Both species occur side by side in German

East Africa, but the cobra is the rarer and the more aggressive, ejecting its venom when approached. In attacking this reptile the negroes raise the left arm to protect the eyes, and afterwards carefully wash off any venom from their bodies, lest it should inflame the skin.

The ring-hals is another species which habitually ejects its venom, and the habit is probably common to all the African cobras. Writing of one of these spitting snakes, the species of which was not determined, an observer states that it was of a bright orange colour, with a green band round its throat and the typical cobra-hood. The writer endeavoured to kill it by inserting sticks into the cage, and his companion having pinned it against one of the corners, he placed his face close to the wire-netting with which the front of the cage was covered. The snake immediately ejected a stream of colourless fluid, a portion of which struck him in the left eye, a drop or two on his lip, and a few drops on the front of his shirt. He almost immediately experienced intense pain in the eye, which increased to such an extent that he was in agony all night.

The genus *Bitis*, it may be added, is peculiar to Ethiopian Africa, where typical vipers of the genus *Vipera* are wanting. Another exclusively Ethiopian genus of vipers is *Atractaspis*, of which eleven species are known, all of them apparently viviparous.

Particular interest attaches to the African egg-eating snake (*Dasypeltis scabra*), which ranges as far north as Sennar, and is the sole representative not only of its genus but likewise of a subfamily of the *Colubridæ*. Although scarcely exceeding a couple of feet in length, this snake is able to swallow and crack hens' eggs. By a great distention of the jaws, the egg is introduced into the gullet, where it is cracked by means of bony knobs forming the summits of the lower spines of the neck-vertebræ, which penetrate the upper wall of the gullet. Snakes of little more than a foot in length can swallow pigeons' eggs, although this involves the distention of the skin of the neck to its utmost extent. When the egg is cracked by being pressed against the aforesaid bony knobs, the swelling suddenly collapses.

Amphibians. The absence of certain groups of animals is almost as characteristic of Ethiopia as is the presence of its many peculiar types. Among these missing groups are the salamanders and newts. The small group of limbless amphibians is, however, represented by three generic groups, of which *Hypogeophis* is confined to Equatorial Africa and the Seychelles, *Dermophis* is common to tropical Africa and America, and *Herpele* is solely West African.

Peculiar to Africa are the spur-toed frogs, of which *Xenopus lœvis* is a well-known southern and western species. These frogs resemble the Surinam toad in being devoid of a tongue, and are specially distinguished by having the five front-toes free, while the five hind-toes are united by a web and the three inner ones armed with sharp spur-like nails.

Till a few years ago the "record" in the matter of size, so far as frogs are concerned, was held by *Rana guppyi* of the Solomon Islands; but this species is exceeded in size by one from the Cameruns which has been named *Rana goliath*, whose head and body measure no less than ten inches. Two large West African tree-frogs, *Hylambates rufus* and *H. brevirostris*, are remarkable for the great size of their eggs, which appear to undergo the greater part, if not the whole, of their development within the mouth of the female parent, from which receptacle specimens have been taken. This remarkable nursery arrangement is paralleled by a South American frog (*Rhinoderma darwini*), in which the eggs are hatched in the vocal sacs, or bladders, whence the young frogs appear in a perfect state, having undergone their tadpole stage within the egg. The genus *Hylambates*, it may be added, together with the allied *Cassina*, *Megalixalus*, *Rappia*, and *Arthroleptis*, is peculiar to Africa, most of the species of these genera coming from the tropical zone, and more especially the west coast. Two other noteworthy Ethiopian amphibians, each representing a genus by itself, are the hairy frog (*Trichobatrachus robustus*) from the Gabun, and Bates's frog (*Campsosteonyx batesi*) from the Cameruns.

Fishes. Three groups of fresh-water fishes stand out as pre-eminently characteristic of Ethiopian Africa, although, as might be expected, and as already mentioned in Chapter I., a certain number of them enter the North African region. The most absolutely peculiar group, and one which has no living representative in any other part of the world, is that typified by the bichir (*Polypterus bichir*) of the Nile, and including other species of the same genus, such as *P. congicus* and *P. delhezi* from the Congo, as well as a second genus from Old Calabar. These fishes are the sole survivors of an ancient group known as fringe-finned ganoids (Crossopterygii), which take their name from the remarkable structure of the first pair of fins. These consist of a short solid basal lobe from which proceed a number of rays so arranged as to give to the whole fin somewhat the appearance of a fan. The tail is of somewhat similar form; and the body is clothed in a complete suit of bony armour, consisting of a number of oblique rows of rhomboidal plates, faced with hard, shining enamel. In shape, the bichirs, which grow to a considerable size, are somewhat pike-like fishes, but are specially characterised by the back-fin being split up into a number of finlets, whence the name *Polypterus*—many finned. The number and size of these finlets, and the length of the spaces by which they are separated from one another, vary with the species. The reed-fish of Old Calabar and the Niger (*Calamoichthys calabaricus*) is of a more elongated shape, and is the sole representative of its genus.

The second peculiar family of Ethiopian fishes is that of the eel-like lung-fishes of the family *Lepidosirenidæ*; the group is, however, not restricted to Africa, as it has a nearly allied representative in tropical South America, and a second, but less closely related, cousin in Queensland. All these fishes breathe in part by lungs, and in part by gills, and collectively constitute the living survivors of the ancient order of Dipnoi. In the young state the African and South American species have external branching gills. The African genus, of which there appear to be three species, namely, *Protopterus annectens* of the Gambia, *P. æthiopicus* of the White Nile and the Albert Edward Nyanza, and *P. dolli* of the Congo, is characterised by the eel-like form of the body, the presence of three tentacles to each gill-opening, and the cylindrical, whiplash-like form of the pectoral and pelvic pairs of fins, which are widely sundered from one another. These fishes grow to very considerable dimensions, and subsist on the frogs, fishes, and insects to be found in the muddy waters in which they dwell. In the dry season they bury themselves in the mud, where they exude a copious slime which causes the mud to form a kind of case round the curled-up bodies. In such mud-nests these fishes have been transported to Europe in a torpid condition.

The third peculiar group is that of the beaked fishes, or *Mormyridæ*, to which reference has been made in the first chapter of this volume. These, like all the fishes noticed below, belong to the great bony group, and are specially characterised by the elongation of the almost trunk-like muzzle, the length and shape of which varies in the different genera. It is a remarkable fact that these peculiar beaked fishes, so eminently characteristic of the fresh waters of Ethiopian Africa generally, are unrepresented in Lake Tanganyika. Another peculiarity in the fish-fauna of that lake is the occurrence of a representative of the Asiatic cyprinoid genus *Capoëta*, known elsewhere in Africa only by a single Abyssinian species.

Some interesting observations on the habits of beaked fishes have been made in the Zoological Gardens at Giza, near Cairo. In a natural state all these fishes appear to be thoroughly nocturnal, but in captivity they soon learn to move about during the daytime, when they will search for the chopped worms on which they are fed. Specimens of the long-nosed species known as *Mormyrus kannume* generally spend the day lying quietly at the bottom of the tank, but after nightfall become very active, searching energetically after food. When a light is thrown on them, their eyes shine in a very remarkable manner, sometimes shining white and sometimes gleaming red. They have also a curious habit of swimming tail-first. There are many genera and species of these fishes, among which the one mentioned above and *Gymnarchus niloticus* of the Nile and the west coast rivers are two of the best known.

Among other fishes, the occurrence of a species of the southern genus *Galaxias* in the rivers of Cape Colony cannot be passed over without notice, as other species occur in South America and Australia, and the genus has accordingly been regarded as adding to the evidence in favour of a former land-connection between the southern continents. In this instance the evidence has, however, been considerably discounted by the discovery of a marine *Galaxias.*

Cat-fishes of the family *Siluridæ* abound in the Ethiopian region, among these being the carmut, or eel-like cat-fish (*Clarias anguillaris*) of the Nile and other rivers. About a yard in length, this fish, which belongs to a genus common to Africa and India, is frequently taken when the water is low. The electric cat-fishes, as typified by *Malapterurus electricus*, are peculiar to African waters. The ishr or so-called Nile perch (*Lates niloticus*), of the family *Serranidæ*, has been referred to in Chapter I. According to observations made at Giza, the natural food of these monsters appears to be live fish only, but they will eat freshly dead fish thrown into the tanks, seizing them as they sink and swallowing them whole. One of the most noticeable points about the ishr is its gleaming eyes, which in some lights glow red like dull signal lamps; another is its power of rapidly changing colour, and the appearance and disappearance of dark markings all over the sides of the body. The carp family (*Cyprinidæ*) is strongly represented in African waters, especially by barbels (*Barbus*), of which nearly two hundred species are known to inhabit Africa. As no remains of the *Cyprinidæ* have hitherto been recorded from the Tertiary formations of the Fayum district of

Egypt, in which remains of *Siluridæ* are abundant, it seems not improbable that while barbels and their kindred are an Asiatic type, cat-fishes may have originated in Africa.

The balti (*Tilapia nilotica*), belonging to the family *Cichlidæ*, is another well-known Nile fish which grows to a large size.

A small fish from the rivers of West Africa, measuring about three inches in length, and provided with elongated pectoral fins, is in the habit of taking aerial flights after the fashion of the true flying-fish and flying-gurnards. This fish (*Pantodon bucholzi*) is the only fresh-water species known to possess powers of this nature. Although allied to the *Osteoglossidæ*, it is regarded as the representative of a special family, the *Pantodontidæ*.

The remarkable absence of eels from the rivers of western Africa has been already referred to in the chapter on North Africa, where mention is also made of the species found in the rivers of other parts of that continent.

Molluscs. Ethiopian Africa as a whole is characterised by the poverty of its fauna of land-snails and slugs in comparison with other tropical regions. Nevertheless, it is, with the exception of a few Malagasy forms, the exclusive home of the agate-snails, as typified by the genus *Achatina*, but including also a number of other generic types which it is unnecessary to particularise. Another feature is the scarcity or poor development of the typical genus *Helix* and its relatives, collectively constituting the family *Helicidæ*, the same remark applying in the case of the *Naninidæ*. It is not, indeed, that the *Helix* group is entirely absent, for it attains a considerable development in the southern part of the continent, but the African species are nearly all small and dull-coloured. In this respect Ethiopia presents a striking contrast to Madagascar, where there are many large and handsome representatives of the group; and it would accordingly seem that while the *Achatinæ* are an original African group, the *Helicidæ* are immigrants into Ethiopia. On the other hand, in possessing a certain number of representatives of the genus *Cyclostoma*, as now restricted, which is peculiar to this region and Madagascar, Ethiopian Africa exhibits affinity with that island. The genus belongs to a family characterised by the mouth of the shell being closed by a horny operculum. These snails are absent from the west coast.

The largest species of *Achatina*, and, in fact, the largest land-snail in the world, is the orange and brown *A. marginata* of the west coast, the shell of which attains a length of 8 inches. In 1908, living specimens of these giant snails were exhibited at the Natural History Branch of the British Museum. Four specimens were received at the museum, all of which on arrival had their mouths sealed by a stout "epiphragm." The two exhibited were induced to become active by immersion in warm water, and appeared to be in full health when placed in the glass jar in which they were shown. Very interesting was it to watch the curious ripple-like movement in the foot as they crawled up and down the sides of their cell. It was also noticeable that a very large proportion of the soft-parts was protruded from the shell. The zebra-snail (*A. zebra*) of southern and western Africa is remarkable for possessing a type of colouring and markings recalling those of Grévy's zebra. Another well-known species is *A. fulica*, a native of East Africa, which was introduced many years ago into Mauritius, where it is now common. To Calcutta it was introduced about half a century ago, and by 1877 was abundant in the gardens of the houses in Chouringhi, while it had also crossed the Hughli to Howra and Barrakpur. About 1900 a collector introduced the species on his estate in the highlands of central Ceylon, but soon after attempts were made to exterminate the intruders, and it was believed effectually. It appears, however, that some escaped destruction, and of these a couple were carried down with vegetables to the low country. Here they increased to such an amazing extent, over an area of about five square miles, that in 1910 their numbers were to be reckoned by millions, no fewer than 227 being counted in a cluster on the stem of a cocoanut palm in a length of about 6 feet. Naturally the natives were in fear that their crops would be devastated; but, as a matter of fact, little or no serious damage was inflicted, and it appears that the species largely acts the part of a scavenger, so that in some degree, at any rate, its introduction was a benefit. The adults are attacked by a terrapin of the genus *Nicoria*, and in its young stages the species probably has many foes. The enormous fecundity of these snails on their first introduction to the lowlands was probably a temporary phenomenon, and their numbers soon began to diminish.

In the great lakes, as well as in many of the rivers, molluscs, both univalve and bivalve, are abundant. Among the univalve types furnished with an operculum to the mouth of the shell, the genera *Lanistes*, *Cleopatra*, and *Meladomus* are exclusively Ethiopian; the same being the case among bivalves with the genera *Mutela* and *Ætheria* in the river-mussels (*Unionidæ*) and with *Galatea* and *Fischeria* in the *Cyrenidæ*. Although the fresh-water snails of the great equatorial lakes are for the most part more or less nearly related to those from other regions, the molluscan fauna of Tanganyika affords a very remarkable exception in this respect. In addition to the ordinary fresh-water types, this lake is the home of a number of snails whose shells present a curious superficial resemblance to those of certain extinct genera of marine gastropods. These have been, somewhat hastily, regarded as remnants of an ancient marine fauna—the so-called halolymnic fauna—which have been cut off from the sea and gradually accustomed to a fresh-water existence. Examination of the soft-parts has, however, shown conclusively that these remarkable genera are nothing more than aberrant types intimately related to more ordinary fresh-water snails. The reason for their abnormality in the matter of shell-form still awaits an explanation.

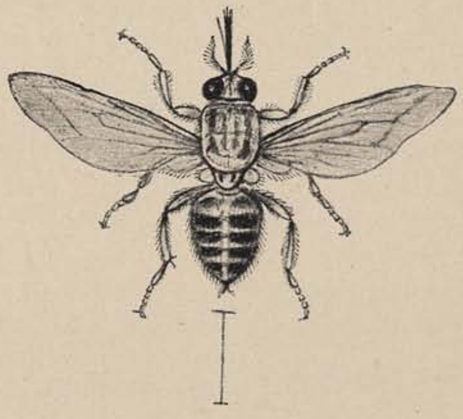
The slugs of South Africa, as specially exemplified by those of Natal, include a considerable number of species, arranged in six families, of which the *Aperaidæ* is represented by the exclusively South African genus *Apera*. Of the five species of this remarkable genus, which was formerly included in the *Testacellidæ*, three are found in Natal. The genus is believed to represent a primitive type, such resemblances as it shows to the *Testacellidæ* being probably due to parallel development. It was originally described as *Chlamydephorus*, a name clashing with *Chlamydophorus*, the title of the fairy armadillo of South America.

Insects.

The large bodily size attained by many members of the Ethiopian fauna is further exemplified in the case of the goliath beetles of the west coast. In the ordinary grey goliath (*Goliathus druryi*) the males, which are velvety black in colour with chalky white markings, attain a length of 4 inches.

Even larger is a species from the Cameruns, in which the thorax is black with five longitudinal white stripes, while the wing-covers, or elytra, are marked with dark crimson. The genus is peculiar to Ethiopia.

Most notorious of all Ethiopian insects are the tsetse-flies of the order Diptera, as typified by the South African *Glossina morsitans*. These flies, which are unknown elsewhere, may be easily recognised when at rest by the circumstance that the wings are folded so as to fit the shape of the body, instead of projecting in two angles, as in ordinary flies. Some interesting notes on the habits of *G. palpalis*, the tsetse-fly of sleeping sickness, are given in one of the issues of the *Bulletin* of the Sleeping Sickness Bureau. In common with other tsetses, this species differs from other flies in that the female, in place of laying eggs, extrudes a single yellow larva or grub nearly as large as her own abdomen, and furnished with a black hood at one end and a pair of minute spines at the other. Immediately after birth this grub commences to crawl actively about in search of a suitable shelter in which to pupate, turning, so soon as this is found, into a hard shining black pupa. From the latter the full-fledged tsetse is developed in the course of five or six weeks. In the Lake Region tsetses do not make their appearance abroad till the sun is well above the horizon, their usual time on a bright still morning being from about 7 to 7.30. Where forest-trees keep off the sun's rays for some hours, the insects may not be seen on the wing till 10 a.m., when they may become numerous; on fine days their numbers begin to diminish from about 4 to 4.30 p.m., and by half an hour before sunset few are to be seen, although in exceptional instances they remain on the wing till the sun has set.



THE COMMON TSETSE.

Though sun seems essential for them to be active, tsetses prefer the shade; in some districts they appear to become a little sluggish in the heat of the day, at which time their desire to bite seems also to undergo a slight diminution in intensity. Wind drives them to shelter at once; and on a windy day not one is to be seen in spots where they abound in calm weather. The swift, irregular flight of these flies is familiar to all travellers in the districts they infest; and it cannot be said whence they come or whither they disappear. As a rule, it seems that their approach is almost noiseless; but, strange to say, there is a certain amount of discrepancy on this point in the accounts of observers. One traveller, for instance, states that the fly's presence may usually be detected by the ear sooner than by the eye, while a second observes that tsetses may be identified by the peculiar buzzing sound they make when on the wing. On the other hand, a third observer states that when tsetses fly quietly their humming is so gentle that it is not always audible even when close to the ear; when, however, they are in wilder flight the humming is loud and accompanied by a sharper undertone. They settle quietly, but by no means always with the intention to bite; and they may often be seen sitting motionless on the bare skin of a native. When eager to bite, it is with great difficulty that they can be driven away. All are agreed that tsetses prefer a black skin to a white one, and dark clothes to light-coloured garments; consequently, if a European be accompanied by natives, he is but seldom molested by these pests. When a tsetse is about to feed, it spreads its legs, and more especially the first pair, so as to bring its whole body nearer to the skin of its victim; and in a second or two the whole proboscis is plunged in to its base, after which it is usually withdrawn to a short distance before the body of the fly begins to become visibly distended with blood. After gorging, the fly seeks shelter and repose in bushes or grass. A sharp prick is usually felt as the proboscis is inserted; but the natives take little notice of the stabs of tsetses, disregarding them more than those of mosquitoes. Although it can pierce khaki or a flannel-shirt, *G. palpalis* does not as a rule attack through clothes. The bite or stab of tsetses is fatal to most domesticated animals owing to the introduction of the germs of an elongated parasite which undergo development in the red corpuscles of the blood. In the case of the above-mentioned *G. palpalis* the parasite of sleeping sickness is introduced in a similar way into the human body. Roughly speaking, the chief tsetse-infested areas are situated in that portion of Africa lying between the southern tropic and the 12th degree of N. latitude, although a belt on the east coast descends considerably to the south of the former zone. Except on the upper part of the west coast, most of the belts follow the river-valleys for longer or shorter distances into the interior. The range of *G. palpalis* is very remarkable, extending as it does from Cape Verde in the north-west, along the west coast to the mouth of the Congo, and then up the valley and across the watershed into eastern Equatoria, in the neighbourhood of the northern end of Lake Rudolf and the eastern side of the Victoria Nyanza. The South African tsetse, or Livingstone's tsetse, as it might well be called, has been detected infesting a small patch of country on the Bahr-el-Ghazal.

In Uganda, where these flies abound, there are at least four species of tsetses, of which *G. brevipalpis* is one of the largest. It is of a dark brown colour, and is only on the wing in the morning and late evening, and seldom seen during the heat of the day except in dull weather. It frequents the banks of rivers, especially where there is a certain amount of cover. *G. longipennis* is only a little smaller than *brevipalpis*, but much paler. It bites freely during the heat of the day and seems to be entirely independent of water, chiefly frequenting barren desert localities. Neither of these is definitely known to carry disease to man or animals in nature. *G. pallidipes* is a smaller, brownish fly, frequenting river-valleys, though probably less dependent on water than *brevipalpis.* It bites at all hours of the day, and is believed to carry disease to domesticated animals. *G. palpalis*, the chief one communicating sleeping sickness, is the smallest of all the above-described species, and is very much blacker. In British East Africa it only occurs, so far as known, in the Nyanza Province, and is confined to the belts of timber on lake-shores and river-banks.

The following account of the habits of these flies is taken, with some abbreviations and verbal alterations, from a report of the Committee of the Natal and Zululand Game Protection Association published in 1911, the species referred to being *G. morsitans* and *G. pallidipes.*

Some fifty years ago it was noticed that the bite of tsetse-flies caused a fatal disease in domesticated animals, and it was thought to be due to some peculiar poison injected by the insect while sucking blood. In 1895 it was shown that the disease called *nagana* in domesticated animals was caused by the presence of vast numbers of a minute blood-parasite (*Trypanosoma brucei*), which was carried to the animals by tsetse. This gave importance to the study of the habits and distribution of tsetses. It has, however, been discovered that the parasite causing the *nagana* disease can occur in blood-sucking flies other than tsetse; *Trypanosoma brucei* having been found in a blood-sucking fly of the genus *Stomoxys*, which belongs to another group.

It was formerly believed that tsetse laid eggs in the excreta of the buffalo, but this is erroneous. As already mentioned, female tsetses do not lay eggs, but produce fully grown yellow grubs. These are born active, and on finding a suitable hiding place, such as a small hole or crevice, change in a few hours into black quiescent pupæ. The fly emerges from the pupa in about five or six weeks. The tsetses exhibit a great dislike to animal excreta, and natives have been known to plaster their animals with such as a protection against the flies. Tsetses of different species are widely distributed through many parts of Africa. They prefer low-lying bush country, and as a rule, although not invariably, near water. They are seldom found in open grass country. Tsetses are exceedingly local in occurrence, and are frequently found to be confined to comparatively narrow strips of country of considerable length, known as fly-belts. Sometimes these belts are very sharply defined, so that within a few hundred yards of apparently uniform country the traveller can pass from an area swarming with flies to one in which they are absent.

The cause of this singular distribution is still unknown, but it is certainly not dependent on the presence or absence of game, as a narrow fly-belt may extend through a wide area with abundance of game, or through a region where game is exceedingly scarce or altogether absent. There are certain observations which show that the tsetses sometimes suck vegetable juices, and it is conceivable that the occurrence of fly-belts is partly dependent on the presence of certain plants, which might be confined to belts dependent on geological out-crops.

Trypanosomes of many kinds have been found in a great variety of fishes, amphibians, reptiles, birds, and mammals. In the majority of cases it appears that these parasites have no obviously prejudicial effect on the host. The trypanosome (*T. brucei*) which causes *nagana* in domesticated animals has been found in the blood of jackals and antelopes, and there is little doubt that it occurs in many different kinds of animals. Tsetses while sucking blood convey the parasite from the first host, where it is innocuous, to the second host, in which it causes malignant disease. The question whether the local destruction of game animals would have any permanent effect in lessening the fly-scourge and reducing the occurrence of *nagana* has received careful consideration, but it is exceedingly doubtful whether any permanent beneficial effect would result from such action.

In addition to tsetses, Africa has many other biting flies, of which the following, according to a report by Mr. S. A. Neave, are the most important.

The majority belong to the family *Tabanidæ*. Among these, the genus *Tabanus* includes a large number of species of, for the most part, stoutly built flies, many of them being of large size. Usually known in England as gadflies or horse-flies, they are often called in Africa hippo-flies, mangrove-flies, or on the Nile serut. These flies are characterised by the possession of rather stout antennæ, in which the second joint is very short and the third or tip is from a lateral view somewhat scimitar-shaped. The proboscis is short, stout, and directed vertically downwards so that it cannot be seen from above. Except in a few species such as the red and green *T. africanus* and its allies, the spot-winged *T. maculatissmus*, and the big black *T. biguttatus*, they seldom have defined dark markings in their wings, though the whole wing is sometimes dusky. The wings are carried when the insect is at rest much as in the house-fly. The genus *Hæmatopota* is also represented in Africa by a large number of species. These flies are comparatively fragile insects, with a more slender body and longer and thinner antennæ than *Tabanus*, the proboscis, however, being directed downwards as in that genus. The wings are mottled and spotted and have dark margins. When the flies are at rest the wings are said to be tectiform, because the angle they make with each other resembles that of the ridge of a roof.

The other two genera of *Tabanidæ* are *Pangonia* and *Chrysops*. The members of the former frequent forest or at least well-wooded areas. They fly with a deep humming note, the females usually biting natives on the shins or ankles. The males are also sometimes to be seen at flowers. The species of the genus *Chrysops* also seem to be confined to wooded localities and the rainy season. They are usually only found at comparatively low elevations, and seldom in large numbers. Lastly, we have the flies of the genus *Stomoxys*, which belong to an altogether different family group. They occur more or less everywhere, but are much commoner in the neighbourhood of human habitations and domestic animals than in the bush, but appear more abundant at higher elevations than in low country. They seem to prefer domesticated animals to man, and are often a serious pest to dogs, the ears of which they attack, causing sores difficult to heal.

Another group of African insects demanding special notice are the white-ants, or termites, forming the family *Termitidæ*. The family, with its one genus, is common to Africa and India, and is also represented by one species (*Termes lucifugus*) in southern Europe, but the African members of the group are the most remarkable of all, and appear to have attained the highest degree of specialisation in the matter of social economy. Many African white-ants construct huge mounds of earth, which may be either conical or mushroom-shaped, and are supported on the outside by buttresses. These pillars, which may be from 12 to 16 feet in height, have no visible external openings, and frequently form conspicuous features in the landscape. From an account given by a missionary in Rhodesia, it almost seems as though white-ants do even more damage in Africa than in India. It is no uncommon thing for the colonist, on returning from his day's labour, to find the coat he left hanging on a nail of his cottage-wall and the books on the table absolutely destroyed by these tiny marauders. Nor is this all, for on awaking next morning he will be astonished to see in the dim light a cone-shaped object rising from the brick floor a short distance from his bed, with two holes on the top like the crater of a miniature volcano. Upon closer examination it will be discovered that the holes have just the size and shape of the inside of his boots, which were incautiously left on the brick-floor the night before. They have given form and proportion to an ant-heap, and nothing is left except the nails, eyelets and, maybe, part of the heels. White-ants, like certain kinds of true ants, cultivate "fungus-gardens." When the colony is in full vigour such funguses are not, however, permitted to grow beyond the "mycelium stage," when they form spongy white masses in the ground, closely resembling so-called mushroom spawn. In Ceylon the white-ant fungus is found solely in the nests of white-ants, and is unknown in any other situation. When white-ant nests are more or less completely deserted, the fungus has a chance of attaining its full development; and in such spots may occasionally be found mushroom-like funguses, which are regarded as delicacies by the natives, and are equally acceptable to the palates of Europeans, their flavour being described as equal, if not superior, to that of the ordinary mushroom. It forms a large flat, white, or occasionally brownish head, with white gills, supported on a long, stout stem, which may be as much as 1 foot in height. Where such a fungus grows, there may be no external sign of a termite's nest, but if its root be traced, it will be found to spring from one of the spongy "spawn" masses peculiar to white-ant colonies. The rarity with which such colonies are evacuated accounts for the scarcity of the mushroom.

The following account of the social economy of white ants is abbreviated from one given in the *Agricultural Journal of India* of 1912.

Numerically the most important individuals in a termite community are the "workers." Apart from reproduction and defence, these carry out practically all the duties required of members of a social body; taking charge of the young, excavating, building up and repairing the nest, foraging for food outside of the nest, and attending to the cultivation of the fungus-gardens. There are often two forms, a larger and a smaller, the functions of which do not appear to be greatly different, though as a rule the larger forms seem to forage, whilst the smaller individuals attend to the internal economy of the nest. The jaws in the workers are well adapted for cutting through fibrous substances such as wood, and it is the workers alone which damage crops and woodwork. Amongst bees and wasps each worker is armed with a powerful sting, used as a rule solely for defensive purposes. In the more highly developed species of white ants the defence of the nest is, however, provided for by a special caste called "soldiers," which are entirely distinct from the workers structurally, and whose business it is to keep order among the latter and to repel assaults upon the nest or foraging-parties. The soldiers have no sting, but are armed with strong biting jaws, and eject a sticky fluid from their heads. The duty of the soldiers appears to be to act solely as defenders of the nest, and in doing this they seem to realise the soundness of the maxim that the best defence is a vigorous offence. In cases when a nest is opened the workers retreat out of sight, while at the same time the soldiers swarm out to repel the disturbers of the peace. Blind as they are, they seem mad with rage and run about with jaws open and ready to seize the foe. On meeting the intruder it is seized firmly in the jaws, sometimes with such determination that the soldier will allow itself to be torn in two rather than relax its grip, whilst the sticky exudation is poured out copiously from the gland in the head. If no enemy can be found, the soldiers gradually retreat into the nest, and the workers bring up earth and repair the breach, but the soldiers continue to line the exposed galleries with their heads directed outward ready to meet a further assault. Except by acting as escort to foraging-parties, the soldiers seem to take no part in procuring food for the community, and the extreme modification of their mouth appears to prevent them feeding on hard substances such as wood. The individuals destined to mature sexual characters are distinguishable in early life by their larger size and the possession of small pads which later develop into wings. These so-called nymphs with wing-pads may be found in some nests at almost any season of the year, but are most common in spring, at which time batches of twenty or thirty may often be found in small chambers within the nest. They do not seem to be provided with fungus-comb as a rule, and it seems probable that instead of eating fungus, they are fed in a special manner, either by food digested and disgorged by the workers or in some other manner. Just before the rains begin, these nymphs attain the perfect state, and, on the occurrence of the first heavy shower, issue out of the nest in swarms. Comparatively very few escape the numerous enemies which prey on them the moment they emerge from the nest. Ants, lizards, and birds catch them before they have time to take to flight, and, even in the air, birds, bats, and dragonflies pursue them relentlessly. The few pairs which find a suitable site, usually in a crack or cranny in the ground, commence the foundation of a new nest by preparing a small rounded chamber just large enough to contain both; this being done by excavating the earth with their mouths and carrying it outside. The female then settles down to the business of laying eggs, to which her future existence is devoted. As the nest grows, the body of the female swells until the brown horny plates which at first formed her back become merely little islands separated by an expanse of white skin; and ultimately she develops into a monstrous, unwieldy, grub-like animal, incapable of walking, and, in fact, a mere pulsating mass of eggs. How long it takes for the female to assume this monstrous shape is not known, but it is probably not less than two years. A female taken from a mound and placed under as natural conditions as possible was found to have laid 359 eggs in fifteen minutes, a rate of oviposition which works out roughly at 34,000 in one day; the extrusion of the eggs being apparently an involuntary action. The growth of a nest-mound is very slow at first, and it is probably not until the second year of its existence that it becomes noticeable above ground. By this time its population has become very numerous and extension proceeds more rapidly. In some cases the building of a mound above ground-level is due largely to the necessity for disposal of the earth excavated below ground in extending the cavity which contains the nest, and the pinnacles of the mound form a kind of scaffolding around the mouths of the galleries up which the excavated material is brought. In other cases, however, these pinnacles are left open, and seem to act as ventilating shafts. The particular shape of the mound varies considerably, and is usually characteristic of each species.

Locusts and grasshoppers of various kinds abound in Africa and inflict great damage on crops. Among the former the two commonest and most mischievous are members of the genus *Acridium*, one being known as the "redwing," and the other as the brown locust. The redwing, which is the larger of the two, and nearly related to the locust of North Africa and Syria (*Acridium peregrinum*), is essentially an Eastern species, the migrations of which are in the main restricted to the districts fringing the Indian Ocean. The brown locust, on the other hand, is as distinctly a Western form, which prefers the dry and desert districts of the interior. In some years, however, owing either to unusual migrations or to prevalent winds, the distributional areas of the two species overlap to a greater or less degree. This was markedly the case during the summer of 1907–8, when Cape Colony, the Transvaal, and Rhodesia were visited by both kinds, while the redwings invaded Natal, Swaziland, and Mozambique. As the two species breed at different seasons of the year, it is essential to determine which has to be dealt with at any particular time in any one district when measures for their extermination are undertaken. The brown locust lays its eggs much earlier than the red species, and in consequence of this the campaign against the immature insects, or "voetgangers," is practically completed before war is waged against those of the red species. The eggs of the brown locust will not hatch till they have received a sufficient supply of moisture, and failing this will remain dormant for a long period—it is said for as much as ten years, although a period of five years is the utmost that has been verified. The eggs of the redwing, on the other hand, hatch in about thirty days after they are laid. Most of the eggs of the brown species are laid from June to August, but some not till September; by the end of the last-named month voetgangers from the earlier batches begin to make their appearance, but the hatching process in the Transvaal is not finished till the following January. When the redwing lays somewhat earlier than usual, voetgangers of both kinds may be simultaneously on the move in certain parts of the country.

A very remarkable locust, *Methone anderssoni*, which inhabits the desert tracts of southern Africa, is the sole representative of its genus, and at the same time one of the largest members of the family *Acridiidæ*. With mere rudiments of wings and very feeble of locomotion, it is a sedentary species which apparently depends for protection chiefly upon its unrivalled vocal powers, which attain their highest development in the males. It is suggested, indeed, that the latter have the power of uttering two distinct kinds of notes: one, which is common to the females, of an altogether peculiar type, and a second which is more or less similar to that of locusts in general.

Jelly-Fish. Lake Tanganyika is the home of a small species of free-swimming jelly-fish, or medusa, which has been made the type of a genus by itself, under the name of *Limnocnida*. This genus appears to be nearly allied to *Limnocodium sowerbyi*, first discovered in the *Victoria regia* tank at the Royal Botanic Gardens, London, and probably a native of the Amazons; a second species, *L. kawaii*, inhabiting the Yang-tsi-kiang. The Tanganyika species has also been discovered in the Niger; and a second generic type, *Mœrisia*, inhabits Lake Karun (the ancient Mœris) in the Fayum district of Egypt. When *Limnocnida* was first discovered in Tanganyika it was regarded, like the above-mentioned snails, as affording evidence of the recent connection of that lake with the ocean.

The evidence was, however, shaken by the occurrence of the species in the Niger, and it is completely discredited by the discovery in the Yang-tsi-kiang. The case is, however, somewhat different with regard to Lake Karun, where there is also found a species of hydroid zoophyte of the genus *Cordylophora*, such zoophytes being normally denizens of estuaries and broads in direct connection with the ocean. Hence it is concluded that Lake Karun had, at no very distant date, free communication with the sea.

Crustaceans.

These conclusions are supported by the essentially fresh-water character of the shrimps of Tanganyika. All the rivers of Ethiopian Africa abound in crabs, but are entirely lacking in crayfishes—a fact of very considerable interest and importance in the geographical distribution of animals.

COQUEREL'S DWARF LEMUR

CHAPTER VI

THE ANIMALS OF MADAGASCAR

ONE of the most remarkable facts in the geographical distribution of animals is the total distinctness of the fauna of the island of Madagascar from that of the African mainland, despite the comparative narrowness of the channel between the two areas. This fact indicates that Africa and Madagascar have been sundered for an extremely long period, although opinions differ as to the approximate number of geological periods which have elapsed since the separation took place. On the whole, the Malagasy fauna presents a closer approximation to that of Africa than to that of any other part of the world, although it has some Indian elements, while as regards reptiles it exhibits a number of types elsewhere represented only in tropical America. Madagascar, which lies well within the tropics, is an elongated island of great extent, lying with its major axis approximately parallel to the African continent. Along this north to south axis runs a backbone of mountains, the eastern flanks of which, facing the Indian Ocean, are clothed with dense forests, while the western slopes are less heavily wooded.

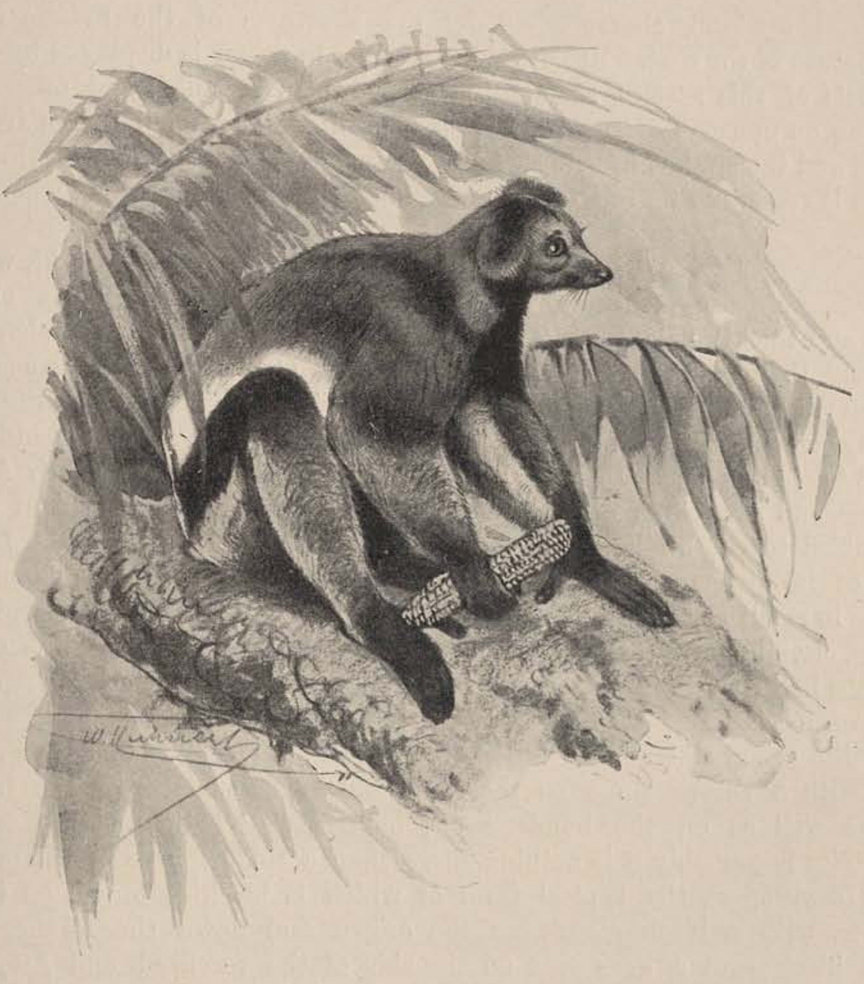
Before referring to the existing members of the fauna it is important to mention that in several parts of Madagascar occur vast marshes from which have been obtained remains of species of animals belonging for the most part to groups now represented in the island, but in many instances of much larger size. From a swamp near Antananarivo have been obtained a very large number of bones and skulls of these forerunners of the present fauna, more especially lemurs. Some of these skulls are referred to species of the living genus *Lemur*, while others apparently indicate a transition from the existing short-tailed indri in the direction of an extinct type described as *Archæolemur*. Most interesting of all is, however, *Megaladapis*, one species of which must have been of the approximate size of an average leopard. Certain features in their structure suggest that some of these giant extinct lemurs may have been aquatic in their habits. There are also indications of affinity between some of these lemur-like creatures and monkeys, which has led at least one naturalist to conclude that there is no justification for referring lemurs and monkeys to distinct subordinal groups.

Indri and Sifaka.

As will be gathered from the foregoing paragraph, Madagascar, in addition to the absence of all large beasts-of-prey save one, is characterised by possessing, at the present day, no monkeys, their place being taken by a great development of that remarkable group of monkey-like creatures collectively known as lemurs. Although the Malagasy lemurs are classed in the same group (Lemuroidea) as the pottos and galagos of Africa, yet they are all perfectly distinct from both; and the same remark applies to the Asiatic lorises. Madagascar is, in fact, the sole habitat of the true lemurs and their near relatives the indri and sifakas; and its lemuroid population far surpasses that of all the rest of the Old World, where the group is alone now found. So numerous indeed are these lemuroids, not only in species, but also in individuals, that some are to be seen in almost every part of the island where there are trees. By the natives they are regarded with superstitious dread, probably owing to the large eyes, weird form, and nocturnal habits of the majority.

The largest of all is the indri, or babakoto (*Indris brevicaudata*), which, together with the under-mentioned sifakas and avahi, represents a special group, regarded by some naturalists as a subfamily (*Indrisinæ*) of the *Lemuridæ*, and by others as a distinct family, *Indrisidæ*. Its second native name means "boy" in the Hova language. In length it measures about 2 feet, inclusive of the rudimentary tail; in colour the coat is a mixture of black and white, in large patches, relieved with numerous shades of grey, the disposition of the colours displaying much individual, or possibly racial, variation. In diet the indri is a vegetarian while in habits it is diurnal, moving about the trees in which it spends its life in an upright posture. A peculiar pouch in the throat acts as a distensible resonating organ, by means of which the indri produces the dog-like howls whence is derived its third native name, amboanata, meaning "the dog of the forest."

Nearly allied are the sifakas, distinguished by their long tails, shorter muzzles, and smaller ears. The largest of the three species is the diademed sifaka (*Propithecus diadema*), which is about 40 inches in total length, of which the tail occupies rather more than half, the dimensions of the head and body and of the tail being 21 and 19 inches respectively. The specific name refers to the white band on the forehead which joins the greyish white whiskers and beard to surround the black face. The crown and back of the head down to the shoulders and chest are dark brown, the back is greyish, the outer sides of the limbs are washed with orange, the extremities are black, and the undersurface is mainly yellowish white. This sifaka inhabits the forests on the east and south of the island, but there is a pale variety in the south and a dark one in the north. These large lemurs live in small bands, and are completely diurnal in habit, being most active in the morning and evening, and sheltering themselves in the forests during the heat of the day. They are well adapted for arboreal life, progressing by means of long leaps, and rarely coming to the ground, where it is difficult for them to



THE BABAKOTO.

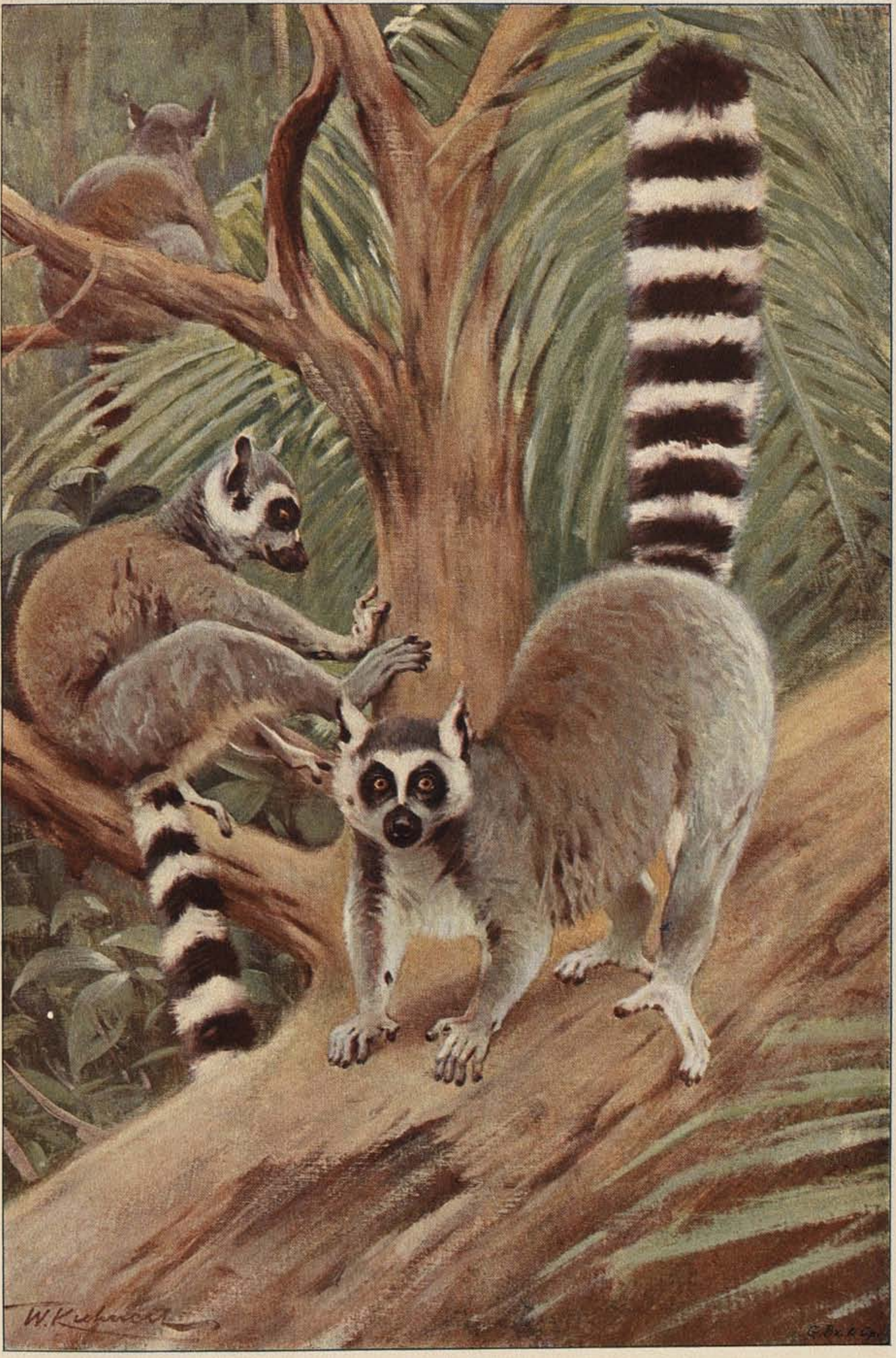
move on all fours owing to the shortness of their arms. They subsist largely on fruit, which they are stated to prefer when green and unripe.

On the sandy wastes of the west and south of the island the diademed species is replaced by Verreaux's sifaka (*P. verreauxi*), which is inferior in size and stouter in build, with a longer head and tail, and white hands and feet. The third species is the crowned sifaka (*P. coronatus*), chiefly characterised by the relatively longer muzzle and pure white tail; it is a native of the north-west coast.

Avahi. By far the smallest member of the group is the avahi (*Avahis laniger*), characterised by the shortness of the muzzle and the woolly nature of the coat. Remarkable variation in colour is displayed by different individuals of this species, some being grey, others brindled, and others, again, displaying an unusually large proportion of white. The avahi differs from both the indri and the sifakas in being wholly nocturnal and not associating in parties, although it resembles its relatives in assuming the upright posture when on the ground.

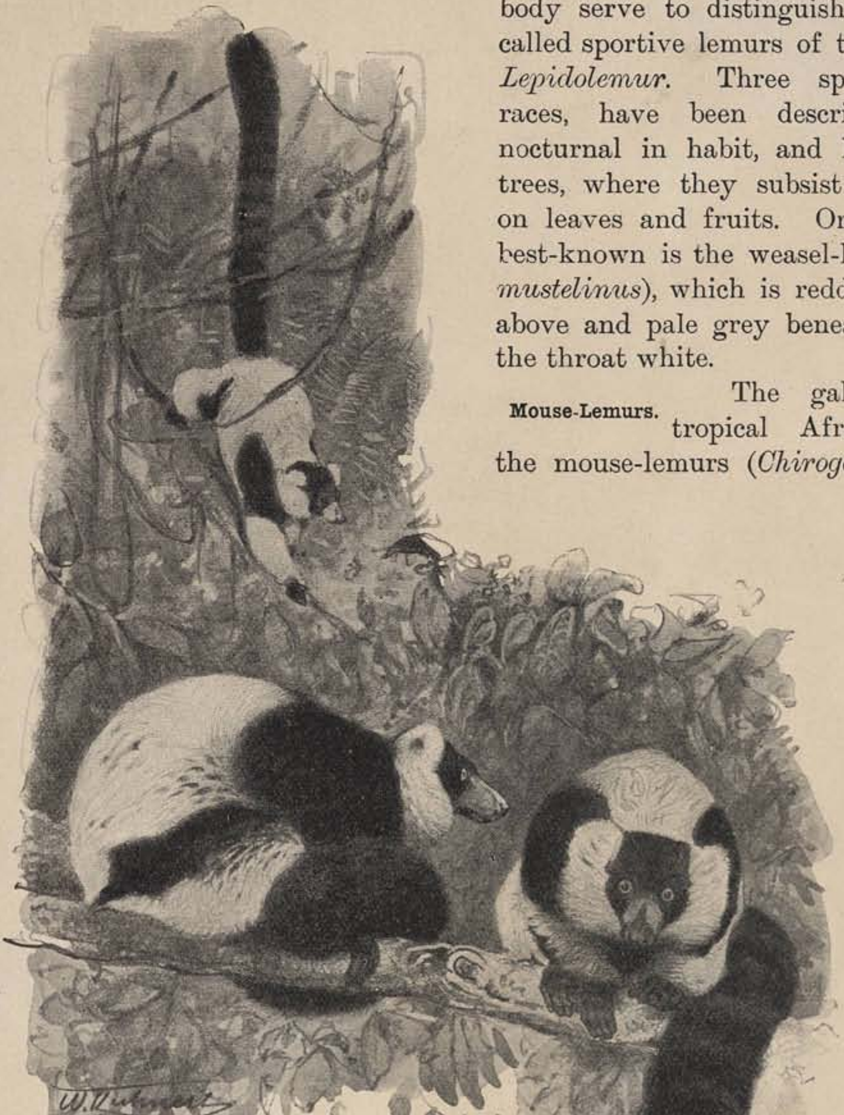
Typical Lemurs. The typical representatives of the family *Lemuridæ*, which, as already mentioned, are restricted to Madagascar, have elongated muzzles and thickly haired ears; when on the ground, owing to the shortness of their limbs, they generally go about on all fours. One of the most common, and at the same time one of the most striking, is the ring-tailed lemur (*Lemur catta*), a delicately coloured French grey species easily recognised by the feature from which it takes its name. In appearance it is curiously like the South American bassariscs, and is peculiar on account of living among rocks, instead of in trees. It is enabled to climb slippery rock-faces with ease on account of the form and nature of its palms and soles, which act almost like suckers. These lemurs associate in small bands, and are most active and noisy in the early mornings and evenings, sleeping during the night and through the noontide heat, like others of their tribe inhabiting the western slope of the central Malagasy chain. Apparently they never drink.

Of the arboreal species, the red-fronted lemur (*L. rufifrons*) is greyish in colour, with a rufous tinge on the front and lower surfaces of the head and body, as well as on the hands, arms, haunches, and the outer side of the limbs. Not improbably it is nothing more than a colour-phase of the mongoose-lemur (*L. mungoz*), the typical form of which is blackish brown on the head and face, with a black streak on the crown and down the forehead, white-fringed black ears, a grey spot on the side of the forehead, and grey cheeks. Colour-phases of this species are known as the red-footed lemur, the grey-headed lemur, the collared lemur, the rufous lemur, and the black-faced lemur. Very distinct is the black lemur (*L. macaco*), characterised not only by its colour, but by the long fringes hanging from the ears and reaching to the mouth, the ears, as well as the whiskers, being white in the females. Largest of all is the ruffed lemur (*L. varius*), which inhabits the north-east coast, and takes its name from the great individual variation in colour. The gentle lemur (*Hapalemur griseus*), on the other hand, is considerably inferior in size to any of the members of the typical genus; and is further characterised by the rounded head and short muzzle and ears. The female differs from other lemurs in having four teats, two on the



RING-TAILED LEMUR.

abdomen, and two on the breast and shoulders. In this particular it resembles the Asiatic lorises. This lemur is confined to the eastern portion of the province of Betsileo.



RUFFED LEMUR.

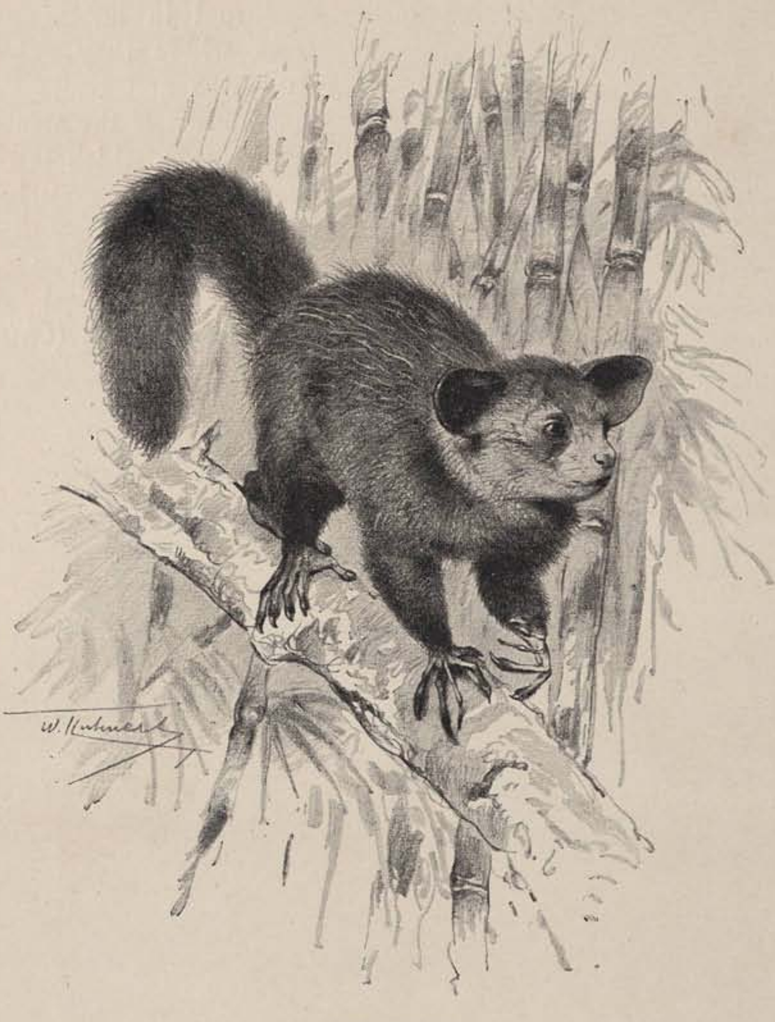
A short, conical head, large and membranous ears, and a tail shorter than the body serve to distinguish the so-called sportive lemurs of the genus *Lepidolemur*. Three species, or races, have been described, all nocturnal in habit, and living in trees, where they subsist entirely on leaves and fruits. One of the best-known is the weasel-lemur (*L. mustelinus*), which is reddish grey above and pale grey beneath, with the throat white.

Mouse-Lemurs.

The galagos of tropical Africa and the mouse-lemurs (*Chirogaleus*) of Madagascar resemble one another in having the bones of the upper part of the ankle much elongated; but the mouse-lemurs are easily distinguished by their large and hairy ears lacking the power of folding. These lemurs have long tails, and are among the smallest of the tribe, some being hardly larger than rats. All have such large, round eyes that they can see the smallest object in the dark;

they frequent the driest districts of Madagascar, and during the hot season become dormant.

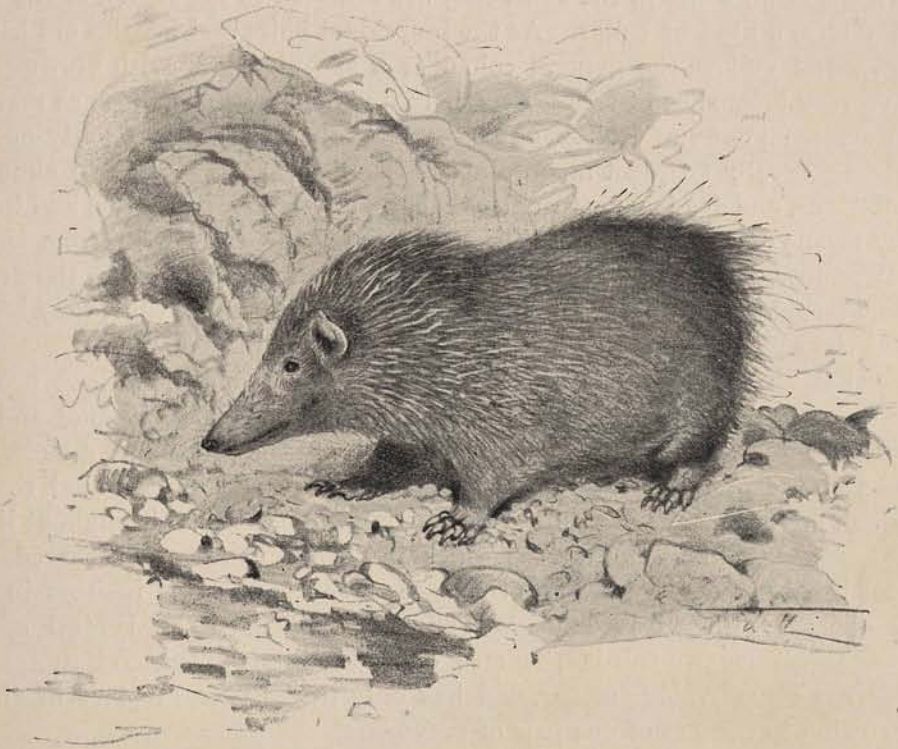
Dwarf Lemur. The dwarf lemur (*Microcebus pusillus*), sometimes termed the Malagasy rat, is pale grey in general colour, and belongs to an allied group distinguished by the fore-limbs exceeding the hind pair in length. Somewhat larger is Coquerel's dwarf lemur (*M. coquereli*), recognisable by its soft woolly fur, which is greyish brown tinged with yellow in colour. These pigmy lemurs, like the last species, build nests, which are firmly constructed of twigs, dry leaves, and grass, measuring about 18 inches in diameter. In these their owners repose comfortably during the day.



THE AYE-AYE.

Aye-aye. The last, and most aberrant, member of the lemur group is the aye-aye (*Chiromys madagascariensis*), long regarded as representing a family by itself, but now considered by some naturalists merely as a highly specialised genus of the *Lemuridæ*. This large-eyed, bushy-tailed, shaggy-haired, blackish lemur is a weird-looking creature, which in the dark might be mistaken for a half-starved Persian cat. In its peculiar dentition it differs widely from all other lemurs, its incisors, which recall those of rodents, being reduced to a single permanently growing, chisel-like pair. As regards its teeth, the aye-aye, in fact, occupies among lemurs a position very similar to that held among bats by the blood-sucking vampires.

Although, as in other lemurs, the thumb is opposable and furnished with a flattened nail, all the other fingers are long, slender, and armed with sharp claws, while the middle finger is remarkable for its extreme slenderness. About the size of an ordinary cat, although incomparably thinner and lighter, the aye-aye has a short, round head and somewhat cat-like face; but the nearly naked ears are much larger than in the cat. The general colour is black mingled with white.



GREATER TENREC.

In habits aye-ayes are strictly nocturnal, passing the day curled up in a large nest of twigs and leaves amidst the dense foliage of tall trees. Part, at least, of their food is formed by wood-boring beetles. Aye-ayes drink by dipping their fingers into water and drawing them through their mouths. When dressing their fur with the attenuated middle finger, they are in the habit of sitting up on their hind-legs; and when sleeping, they curl the bushy tail round the body.

Tenrecs.

Equally as peculiar as the lemurs are the Insectivora of Madagascar, among which the most important place is held by the family of tenrecs (*Centetidæ*), which are restricted to the island. Their spiny covering gives them a superficial resemblance to hedgehogs, from which, however, they differ markedly in the form of their teeth, as well as in many other characters. The stuffed specimens commonly seen in museums give no adequate idea of the form of these strange animals, whose bodies may be compared to those of inflated globe-fish. Perhaps the most peculiar feature about them is the swollen condition of the hinder part of the palate, which is, of course, only seen when they yawn—a habit in which they seem fond of indulging.

The typical member of the family is the greater tenrec (*Centetes ecaudatus*), a practically tailless mammal, the males of which measure a little over 16 inches, and are thus the largest of all Insectivora. In both sexes the coat consists of a mixture of flexible spines, bristles, and hairs, the spines in the young being arranged in three lines down the back, while in the adult they are confined to the region of the neck, where they form a kind of collar. As the individual hairs and bristles are banded with brown and yellow, the general colour is a speckled yellowish brown. The males have very long, sharp tusks. Female tenrecs commonly produce as many as fifteen or sixteen young at a birth, and sometimes even twenty or twenty-one.

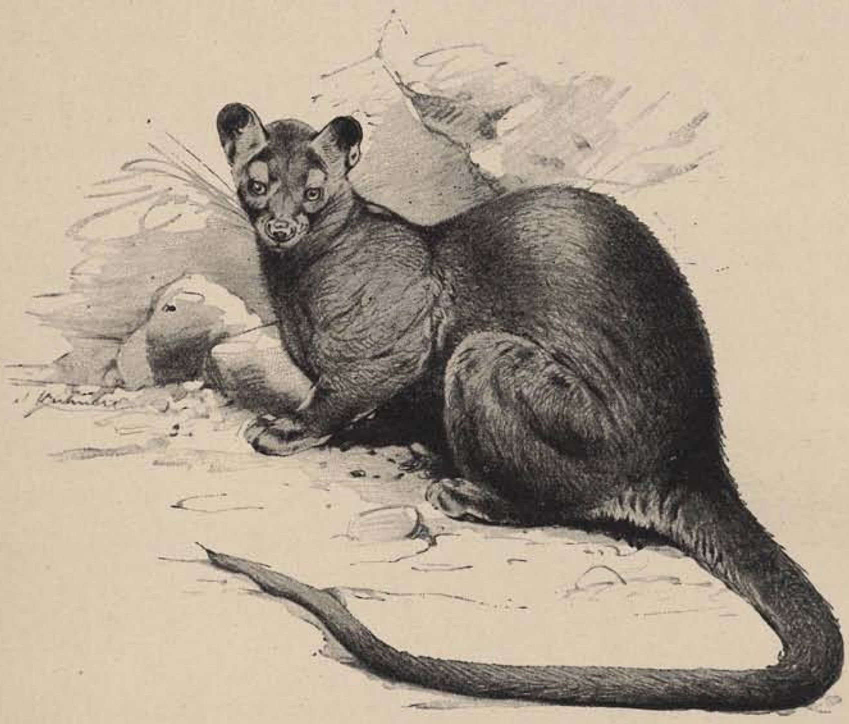
Tenrecs generally frequent mountainous districts where there is an abundant growth of ferns, and lead a nocturnal existence, subsisting on worms and insects dug up by means of the long, flexible snout. During the dry season, from May or June to December, when they cannot find suitable food, they burrow in the ground and become torpid. Like other animals which lie dormant for a time, they become very fat at the commencement of the period of repose.

Somewhat different animals are the striped tenrecs, of which there are two kinds, namely, the typical striped tenrec (*Hemicentetes semispinosus*) and the black-headed tenrec (*H. nigriceps*), the former being about the size of a mole, with black and yellow stripes on the back. In both species the longitudinal rows of spines, which are lost in the adult of the common tenrec, persist throughout life.

The hedgehog-tenrecs (*Ericulus*) differ by being completely covered with short, stout bristles, and have but two (in place of three) pairs of incisors in each jaw. In appearance they resemble a young hedgehog. The typical species, *E. setosus*, is about two-thirds the size of a hedgehog; but Telfair's tenrec (*E. telfairi*) is considerably smaller, and has only thirty-four in place of thirty-six teeth, owing to the loss of one pair of premolars.

Of a totally different type are the long-tailed tenrecs, as typified by *Microgale longicaudata*, which are mouse-like animals with exceedingly long tails and the fur free from spines. In the species named the tail is double the length of the body—a condition paralleled in the case of the long-tailed pangolin. The rice-tenrecs, as exemplified by the four-toed *Oryzorictes tetradactylus*, on the other hand, are more like moles in appearance and habits, having short tails and leading a subterranean existence. They take their name from the damage they do to the rice-fields. From the typical species the Hova rice-tenrec (*O. hova*) differs by having five front toes. The imperfectly known *Geogale* is believed to be a small relative of the otter-shrews of equatorial Africa; and there is one species of musk-shrew (*Crocidura*) in the island.

Bats. One of the most noteworthy features in connection with the Malagasy representatives of this order is the presence in the island of true flying-foxes of the typical genus *Pteropus*, which, as we have seen, are totally absent from Africa. These bats also occur in the Seychelles, and extend from India through the Malay countries to Australia. The three species of fruit-bats constituting the genus *Eidolon* are restricted to the island. They are related to African types. The most remarkable of all the Malagasy Chiroptera is the exceedingly rare golden or sucker-footed bat (*Myzopoda aurita*), which has been regarded as representing a family by itself, and may perhaps be allied to a still rarer New Zealand species known as *Mystacops tuberculatus*. This bat was described in 1878, on the evidence of a single specimen, and it was not till 1899 that the British Museum acquired its solitary example of the species. Apparently the Malagasy bat is nearly allied to the South American *Mormops*, and if, as suggested, it be also related to the New Zealand *Mystacops*, we shall have further evidence in favour of a former land connection between Madagascar (by way, perhaps, of Ceylon), Polynesia, and South America. The occurrence of the same generic type of tortoises, *Podocnemis*, in Madagascar and South America, may perhaps be explained by independent southern migration from the Northern Hemisphere, where kindred types occur in the fossil state; but it is very doubtful if such an explanation will serve in the case of the bats any more than it will in the occurrence of allied types of shallow-water molluscs on both the New Zealand and the Patagonian coasts.



THE FOUSSA.

Foussa. The Carnivora are but very feebly represented in the island, the largest species being the animal commonly known as the foussa (*Cryptoprocta ferox*), which although classed with the civets in the family *Viverridæ*, yet differs very markedly from all the rest of the group, and in the characters of its teeth presents some approximation to the cats. In size this animal may be compared to a slenderly built cat, with an enormously long tail, and short reddish fawn fur. The five-toed feet are armed with sharp, retractile claws, and the entire sole of the foot is naked and applied to the ground in walking. The question of the affinities of the foussa has given rise to considerable differences of opinion; some naturalists regarding the foussa as closely related to the cats, while others associate it with the civets. According to the latest researches, its relationships are with the civets, the whole structure of the animal, the arrangement of the foot-pads, the structure of the skeleton, the development of the auditory bulla of the skull, the brain, in some degree the teeth, the liver, and to a great extent the muscles being decisive on this point. On the other hand, it cannot be placed in the same sub-family with either the civets or the mongooses, since it possesses primitive features which are doubtless common to the ancestors of both. Very noteworthy is the fact that some of these characters connect *Cryptoprocta* on the one hand with the cats (*Felis*), and on the other with the under-mentioned Malagasy genera *Galidia* and *Eupleres*. The latter relationship is of interest as affording additional evidence as to the mutual affinity of the members of the mammalian fauna of Madagascar, the ancestors of which would appear to have simultaneously reached the area now inhabited by their descendants at a time when it was still connected with the old Indo-African continent. It should be added that a second species of foussa has been described under the name of *C. majori*, but this may perhaps be only a race of the typical species. Very little is known with regard to the habits of the foussa, although it is credited with an excessively savage disposition. All the other Carnivora are likewise *Viverridæ*.

STRIPED MONGOOSE.

Mongooses. The mongooses, which form the second group of Malagasy Carnivora, differ greatly from those of the neighbouring continent, this being especially the case with the striped *Galidictis striata* and *G. vittata*, which represent a genus by themselves, and differ from one another in the width of the dark stripes down the back. Another kind, *Galidia elegans*, is distinguished by the tail being ringed with black after the manner of the ring-tailed lemur. A third type is represented by the brown-tailed mongooses (*Hemigalidia*), characterised by the uniformly coloured tail, pointed muzzle, and slightly curved claws. More remarkable still is the small-toothed mongoose (*Eupleres goudoti*), in which the canine teeth are so small and weak as to be scarcely distinguishable from the anterior cheek-teeth, and the whole dentition is so like that of the Insectivora that the animal was formerly regarded as a member of that group. Its food apparently consists of insects and worms.

THE SMALL-TOOTHED MONGOOSE.

Rodents. In the rodent order the entire families of the squirrels (*Sciuridæ*), dormice (*Gliridæ*), octodonts (*Octodontidæ*), and hares (*Leporidæ*), which are so well represented on the African mainland, are completely absent from Madagascar. The mouse tribe, on the other hand, is represented by a peculiar group allied in the structure of their cheek-teeth to the hamsters, and regarded by some naturalists as a subfamily (*Nesomyinæ*) of the *Muridæ*, but by others as a special family, the *Nesomyiidæ*. The group is represented by eight genera, namely, *Brachytarsomys*, *Nesomys*, *Hallomys*, *Brachyuromys*, *Hypogeomys*, *Macrotarsomys*, *Gymnuromys*, and *Eliuromys*. It will be unnecessary to mention the distinctive characteristics of these genera on the present occasion; but it is important to notice that *Anomalomys* of the Miocene Tertiary formation of southern France is believed to be a member of the same group.

Bush-pig. Although remains of two rather small species of extinct hippopotamuses (*Hippopotamus madagascariensis* and *H. lemerlei*) are met with in the swamps of the island associated with those of the fossil lemurs alluded to above, the only hoofed mammal now inhabiting Madagascar is a bush-pig

(*Potamochœrus edwardsi*) nearly allied to the African species. It has been suggested that this species reached the island from the mainland by swimming the Mozambique Channel by way of the Comoro Islands, when it was narrower than at present; but if this be so, the same must hold good for the fossil hippopotamuses, and difficulties have been suggested in regard to accepting the hypothesis in their case. On the other hand, if these species entered Madagascar by means of a land-connection with Africa, it is difficult to see why other animals did not avail themselves of the same route.

KIROMBO.

Perching Birds.

The birds of Madagascar, although not perhaps so remarkable and peculiar as the mammals, nevertheless include a number of distinctive types. In the perching order four genera of shrikes (*Laniidæ*) are restricted to the island. Among their representatives, reference may be made to *Artamia leucocephala*, a species in which the head, throat, and under-parts are white, while the back, wings, and tail are greenish black with metallic reflections; the allied species (*A. bicolor*) being cobalt-blue, instead of black, on the upper-parts. These birds, commonly known as tree-starlings, bear considerable resemblance to another Malagasy species (*Falculia palliata*), which is bluish black on the back, wings, and tail, and is really one of the starlings. Another bird generally grouped with the shrikes, but sufficiently distinct to represent a family by itself, is the helmet-bird (*Euryceros prevosti*), characterised by the ridge of the beak running right up into the feathered tract with a sharp cutting-edge. In size this bird is rather larger than a jay; in colour it is purplish black on the head, throat, and under-parts, chestnut on the back and wings, and black on the tail, except for the black-edged chestnut middle feathers. Belonging to a very different group of perchers, is the genus *Philepitta*, which is peculiar to the island; the most brilliantly coloured species being *P. jala*. In this striking species the male is black with yellow margins to the feathers, while the female is olive-green with a pale yellow streak above and below the eye, and pale yellow beneath with greenish stripes on the sides. Allied to the rollers is the remarkable kirombo (*Leptosoma discolor*), a stoutly built bird with a large head, a sharply ridged beak, and a rather long, square tail. In colour the cock is bronze-green on the head, back, wings, and tail, grey on the sides of the head, throat, and chest, and white on the abdomen; while the hen has a reddish brown head striped with black, yellowish under-parts with black spots, and the wings speckled reddish brown. Of the approximate size of a crow, this bird associates in small flocks on the skirts of the forest, where it

THE THRUSH-ROLLER

performs curious evolutions in the air, soaring, hovering, beating its wings, and finally swooping towards the ground, while all the time it utters its cry of "too-hoo, too-hoo, too-hoo." The kirombo is the sole representative of its genus.

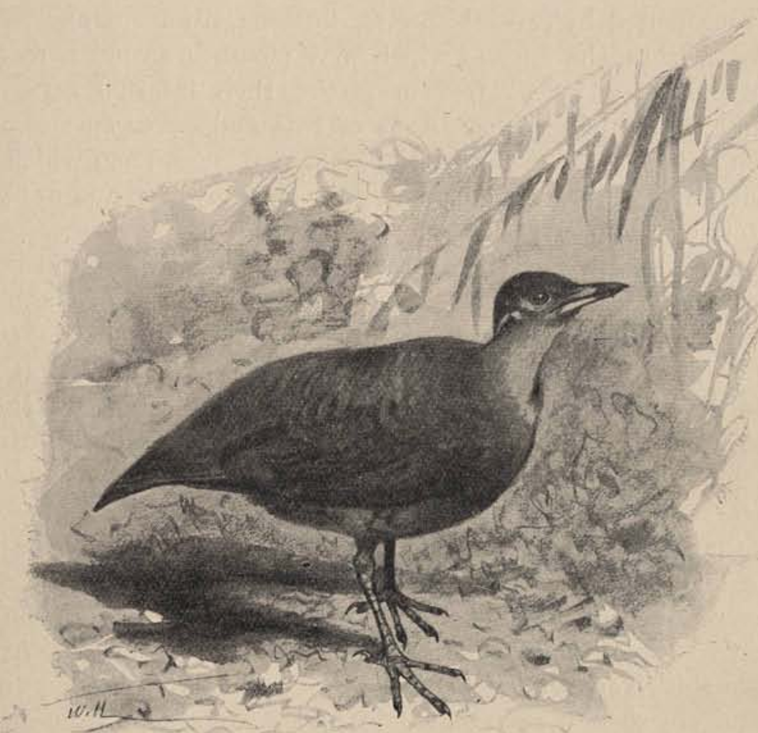
The five genera of ground-rollers, which are likewise peculiar to Madagascar, have comparatively short wings and long legs, and live on the ground, seldom flying, perching only on low branches, never leaving the woods, and seeking their food only in the twilight. Among them, the thrush-roller (*Atelornis pittoides*) somewhat resembles both a pitta and a thrush. In colour it is reddish green above and fawn below, with a blue band at the base of the white throat, white bars on the primaries, a blue head, and the tail blue, except for the middle feathers, which are brown.

THE DUTCH PIGEON.

Silky Cuckoos. In a totally different group of birds, the numerous species of silky cuckoos of the genus *Sericosomus* constitute a characteristic Malagasy type. The smallest is of the size of the European cuckoo, while the largest rivals a magpie in dimensions. Reynaud's silky cuckoo (*S. reynaudi*), which is intermediate in this respect, is metallic green above and pale grey beneath with a reddish brown crown to the head.

Parrots. In the Psittaci, or parrot group, the vasa parrots (*Coracopsis*), characterised by the thick, compressed, and elongated whitish beak, the straight or slightly rounded tail, somewhat longer than the wings, the naked or slightly feathered lores, and the presence of a bare region round the eye, form a group restricted to Madagascar and the Seychelle and Comoro Islands. Among them the lesser vasa parrot (*C. nigra*), which is a royal bird, is dark brown with slaty grey wings, a white beak, and flesh-coloured skin. Living in small flocks, and at times flying high, it is largely terrestrial in its habits, and remarkable on account of its shrill cry. Another well-known Malagasy parrot is the grey-headed love-bird (*Agapornis cana*), which is common to the Mauritius, and has violet reflections on the grey head, neck, and breast, and the rest of the plumage greenish, save for a black bar on the tail. The female, on the other hand, has the head and throat green.

Pigeons. Among the Columbæ, the wart-pigeons (*Alectrœnas*) are confined to Madagascar and the neighbouring islands. One species (*A. nitidissima*) formerly inhabiting Mauritius, where it was known as the Dutch pigeon, from its colouring, became extinct during the last century, when its name became transferred to an allied species (*A. pulcherrima*), in which the crown is red, while the upper-parts are dark blue and the lower surface grey. It is about the size of a turtle-dove and common to Madagascar and the Seychelles.



MADAGASCAR KAGU.

Kagu. A very curious bird is the Malagasy kagu (*Mesites*, or *Mesœnas, variegatus*), noteworthy for its five pairs of powder-down patches, and differing in so many other respects from its apparent cousins, the cranes, that it has been grouped in a separate family. In colour it is cinnamon-brown above, and whitish with black spots below, the head being marked with a white stripe and the breast with a rufous bar. The plumage of the back is so delicate that the feathers curl forward so soon as the bird dies. By some naturalists *Mesites* is considered to be related to the kagu (*Rhinochetes jubatus*), of New Caledonia, although by others the two are widely sundered.

A peculiar generic type of bird from Madagascar has been described under the name of *Monias benschi*. It is believed to be a member of the rail group, and is characterised by its long curved beak and the generally brown tint of the plumage of the upper-parts; the breast being maroon and the abdomen rosy. Only a single specimen has been obtained.

Although this work is mainly concerned with the animals of the present day, reference must be made to the occurrence in the marshes of Madagascar of bones and egg-shells of gigantic flightless birds, the nearest relatives of which appear to be the kiwis and moas of New Zealand, referred to in a later chapter. Apart from their zoological importance, these remains are of interest from an historical point of view, as it seems highly probable that the huge eggs, which were doubtless well known to the Arabs who visited the island in early days, gave rise to the legend of the "roc" of the *Arabian Nights.* These birds, to which the name *Æpyornis* has been given, are represented by several species, differing from one another in size. Largest of all is *Æ. titan*, the eggs of which may measure as much as 3 feet in their longer circumference by 2½ feet in girth; their internal capacity being rather more than a couple of gallons. Eggs of this and other species are by no means uncommon in the sandy banks of the Malagasy lakes, from which they are often washed out during storms, when they float on the water and are picked up and sold to visitors by the natives.

Reptiles. The reptiles of Madagascar, so far as tortoises and snakes are concerned, present a curious affinity to those of both tropical America and Africa. Old World relationships are, however, displayed by the existence in the interior of the island of a species of crocodile (*Crocodilus robustus*). Affinities with the Mascarene fauna are indicated by the former existence in the island of a species of giant land-tortoise (*Testudo grandidieri*), shells and skeletons of which have been obtained in an almost perfect condition from the marshes.

Turning to the side-necked fresh-water tortoises (Pleurodira) of the Southern Hemisphere, we find the genus *Podocnemis*, which contains at least six South American species, represented in Madagascar by *P. madagascariensis.* On the other hand, the genera *Sternothœrus* and *Pelomedusa* are common to Africa and Madagascar. The soft river-tortoises (*Trionychidæ*), which form a subordinal group by themselves and are so well represented in Africa, are absent from Madagascar, as they are from South America.

South American affinities are most pronounced in the case of the python family, where the genus *Boa*, as typified by the well-known *Boa constrictor* of tropical South America, is represented in Madagascar by the two smaller species respectively known as *B. madagascariensis* and *B. dumerili.* The allied genus *Corallus*, with several tropical American species, has likewise one outlying Malagasy member (*C. madagascariensis*). The Indo-African pythons are conspicuous by their absence from the island, and the same holds good for the entire group of vipers.

On the other hand, African affinities are indicated by the abundance of chamæleons in Madagascar, where the type genus is represented by *Chamæleon bifidus* and *Ch. parsoni*, the latter being the giant of the family, attaining a total length of 2 feet. In both these species there is a remarkable difference between the sexes, the males carrying a pair of long, horn-like processes which extend in front of the muzzle. The dwarf chamæleons of the genus *Brookesia*, one of which is not more than 3 inches in length, are peculiar to the island.

Geckos of various kinds occur in the island, as they do throughout the tropical and subtropical zone of the globe. Among these, the most remarkable is the bark-gecko (*Uroplates fimbriatus*), which represents a generic type peculiar to the islands, and takes its English name from the resemblance of the mottled black-and-white skin to the lichen-clad bark of the trees on which it dwells. The tail is short and trowel-like, and the blood-red eye unusually large. The Old World families of agama lizards (*Agamidæ*), monitors (*Varanidæ*), and typical lizards (*Lacertidæ*) are, however, absent. On the other hand, Ethiopian affinities are again exhibited by the occurrence of the typical genus of lizards of the family *Gerrhosauridæ*, which are otherwise exclusively African. Of the great family of scinks (*Scincidæ*), there are several Malagasy representatives.

Amphibians are represented, and that but poorly, by certain frogs of the typical family *Ranidæ*, which are mainly of African affinities. There are, for example, a few species of the genus *Arthroleptis*, the other members of which are restricted to Africa and the islands of the Indian Ocean; while the peculiar Malagasy genus *Mantella* appears to be related to the Ethiopian *Dendrobates*. Toads (*Bufonidæ*) and true tree-frogs (*Hylidæ*), as well as the limbless cœcilians (*Cœciliidæ*), are entirely lacking.

Fishes and Invertebrates. Information with regard to the fresh-water fishes of Madagascar is still very incomplete. In addition to certain gobies and species of *Dules*, which are not truly fresh-water types, a few representatives of the *Chromidæ*, a family common to South America and Ethiopian Africa, are known.

Regarding its land-snails, the island differs very notably from Africa south of the Sahara. The latter area, as stated in the preceding chapter, is characterised by its poverty in snails of the *Helix* group and of the operculated family *Cyclostomatidæ*. Madagascar, on the other hand, forms the headquarters of the genus *Cyclostoma*, of which it possesses more than fifty species; the genus also occurs in the Seychelles, the Comoros, and Mauritius. The *Helix* group is well represented, the two peculiar generic, or subgeneric, types *Helicophanta* and *Ampelita*, which are unknown in the islands just mentioned, containing remarkably large and handsome species. Of these, *Helicophanta souverbiana* has a large shell of a rich brown colour, measuring about 3 inches across, and distinguished by the unusually large size of its embryonic portion, which forms the summit of the flattened spiral. The agate-snails (*Achatina*), so numerous in Africa, are scarce, and the Ethiopian genera *Pachnodus* and *Rachis*, belonging to the *Bulimus* group, are represented only by two species. In the same group the presence of a species of the otherwise exclusively Oriental genus *Kaliella*, which has been regarded as inseparable from one of the Indian forms, is very remarkable. This Indian affinity, which is paralleled in the case of the flying-foxes of the genus *Pteropus*, is further borne out by the occurrence in the rivers of Madagascar of species of *Paludomus*, a genus essentially Oriental, with a few representatives in the Seychelles and Somaliland. *Melanatria*, again, is an exclusively Malagasy type, with relationships to certain Sinhalese and Indian snails. Moreover, some of the Malagasy species of *Melania*, characterised by the elongated spiral of the blackish shell, and others of *Bithynia*, are quite unlike the Ethiopian representatives of these genera, but near akin to Indo-Malay forms.

Of crayfishes, Madagascar has the genus *Astacoides*, allied to Australian, New Zealand, and South American types, thereby displaying another marked point of difference from Africa.

As regards the insects of Madagascar, the following extract from Dr. A. R. Wallace's *Geographical Distribution of Animals* puts the matter in a brief but clear form:—

"Taking the insects as a whole, we find the remarkable result that their affinities are largely Oriental, Australian, and South American; while the African element is represented chiefly by special South African or West African forms, rather than by such as are widely spread over the Ethiopian region. In some families [of beetles]—as *Cetoniidæ* and *Lamiidæ*—the African element appears to preponderate; in others—as *Cicindelidæ*—the South American affinity seems strongest; in *Carabidæ* perhaps the Oriental; while in *Buprestidæ* and *Cerambycidæ* the African and foreign elements seem nearly balanced."

The foregoing brief sketch of the leading features of its fauna is amply sufficient to indicate the propriety of regarding Madagascar as a zoological region by itself, this Malagasy region standing on the same level as the Ethiopian and the Oriental regions of Arctogæa. This view is now adopted by a considerable number of naturalists, although the study of the geographical distribution of bird-eating and trap-door spiders has induced one investigator to adopt the older view that Madagascar forms part of the Ethiopian region. With this exception, it is interesting to note that the geographical distribution of trap-door and bird-eating spiders denotes that the zoological regions into which the world may be mapped out from the evidence of this group are practically identical with those indicated by mammals and birds. The importance of this can scarcely be over-estimated.

ALDABRA GIANT TORTOISES.

CHAPTER VII

BIRDS, TORTOISES, AND MOLLUSCS OF THE MASCARENE, COMORO, AND SEYCHELLE ISLANDS

To the eastward and northward of Madagascar are several groups of small islands which collectively form the Mascarene zoological province. The Mascarenes, or Mascarenhas, themselves are situated to the east of the great island, and include Réunion (Bourbon), Mauritius, which is considerably larger than either of the other two, and Rodriguez. To the north-westward of Madagascar are the small islands of North and South Aldabra; and due north-east of these, at a longer distance, lie first the small Amirantes, and farther on the Seychelles, which are larger. Almost midway between the northern point of Madagascar and the Mozambique coast, although nearer to the latter than to the former, are the islands of the Comoro group, situated at the head of the Mozambique Channel.

One of the Seychelles is famous as being the source of the wonderful "double cocoanuts," or *coco-de-mer*, which are found floating in the Indian Ocean, and the origin of which was for years unknown. They are the product of a palm (*Lodoicea sechellarum*) which grows only in a few sheltered valleys in this island.

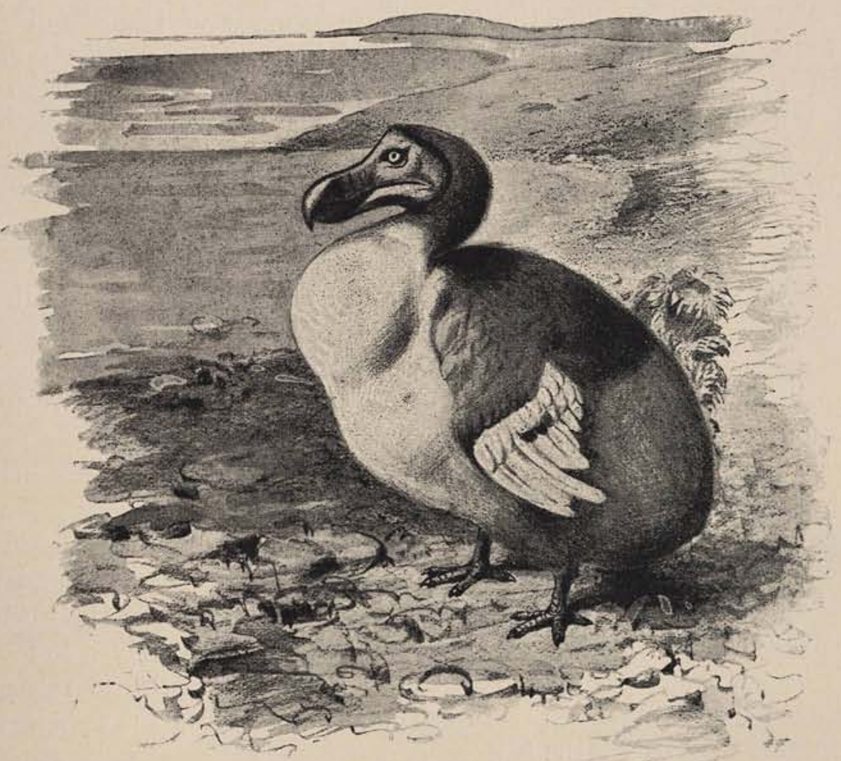
Till a comparatively recent date many of these islands were the homes of some very remarkable types of birds, which have no near relations now living; while they were, and to a certain extent still are, the habitat of an extraordinary number of species of giant land-tortoises, a group known elsewhere at the present day only in the Galapagos Islands, off the Pacific coast of South America.

Birds.

Till about the middle of last century the island of Réunion, or Bourbon, was inhabited by the pied starling (*Fregilupus varius*), the sole representative of its genus. Easily recognised by its parti-coloured plumage, long curved beak, and elongated crest, this bird was probably discovered by Flacourt in the middle of the seventeenth century. In the early part of the last century it was abundant, but in 1833 had become extremely scarce, and by about 1860 had probably ceased to exist even in its last refuge in the interior of the island. Twenty-one skins, of which one is in the Natural History branch of the British Museum (although not shown to the public), and two skeletons, of which one is at Cambridge, are all the relics of this interesting species that can be identified.

In the same island flourished up to the year 1761 a dodo (*Didus borbonicus*) near akin to the typical Mauritius species to be mentioned next, but distinguished by the first four primary quills pointing downwards and forwards. In colour it was white and yellow. Two skeletons of this species are preserved at Cambridge. The true dodo (*D. ineptus*) of Mauritius was, on the other hand, grey in general colour with a whitish breast and tail, and black tips to the yellowish white wing-coverts, the first four primaries being directed backwards. In both kinds the wings were useless for flight, and the most striking feature of both was the enormous beak, which terminates in a hook. The dodo appears to have been first mentioned in 1598 by the Dutch Admiral Cornelius Van Neck, who called it the walghvogel, and stated that in his opinion the flesh was unpleasant in flavour. Three years later a picture by De Bry is stated to have been painted from a specimen brought alive to Holland. During the next thirty years many portraits of this strange bird were executed, the best known being those by the two Saverys, which are preserved in various museums, and the one by Goivinau at Sion House. From these portraits, as well as from the skeleton and certain parts of the body which have been preserved, we learn that the dodo was a clumsily built bird as large as a turkey, with short legs, a sparse covering of curly feathers on the body, and a tuft of feathers on the tail resembling a small feather-brush. Unaccustomed to the presence of man, the dodo,—meaning simpleton,—as it was called by the Portuguese on account of its stupid, sluggish habits, showed no fear and no inclination to attempt to escape when approached. Consequently it was not long after the discovery of Mauritius that it became extinct, the last mention of the living bird occurring in the log-book of Mr. Benjamin Harvey, who visited Mauritius in the year 1681. In the meantime several living specimens of the bird were brought to England. Herbert Altham, for instance, made a picture of one in 1628; a second reached the Anatomical School at Oxford, six years later; and a third was exhibited in London in a travelling show about the year 1638. Several examples were also acquired by museums, among them being one belonging to Tradescant, of which the head and one foot are still preserved at Oxford. From the time of its extermination nothing more was heard of the dodo till the year 1868, when a large number of its bones were dug up in a marsh in Mauritius known as Mare-aux-Songes. At the beginning of the nineteenth century this swamp and the adjacent land were covered with large trees, the fruit of which probably served the dodos as food. Here those great birds seem to have lived and died in peace, the bones showing no signs that they met violent deaths.

Another member of the same extinct family—*Didid*—is the solitaire, *Pesophaps solitarius,* of Rodriguez, a small island lying to the eastward of Mauritius. A less ungainly bird than the dodo, the solitaire had a longer neck and legs, and a smaller beak. The males stood 33 inches in height, but the females were 6 inches shorter. Discovered by the French voyager François Leguat in 1691, the solitaire was last mentioned as being alive in the year 1761. From time to time a few of its bones were found, but in 1864 a discovery in a cave led to such a thorough exploration that in the course of five years an enormous number of its remains were collected, and from these several more or less nearly complete skeletons have been mounted, and are exhibited in various museums. A remarkable peculiarity in the structure of the solitaire is the presence of a bony knob on the fore part of the wings of the males. According to Leguat's account, the males were very combative and fought with their wings, when these knobs striking together made a noise compared to the report of a pistol.



THE DODO

The nearest living relative of the dodo and the solitaire is the tooth-billed pigeon (*Didunculus strigirostris*) of Samoa, referred to in a later chapter.

Giant Tortoises.

As mentioned above, the islands of the Mascarene group, in common with Madagascar, were formerly the home of a large number of species of giant land-tortoises. These tortoises, all of which are characterised by the blackness of the horny plates covering their shells, like their relatives of the Galapagos Islands, are nothing more than overgrown representatives of the genus typified by the common tortoise of southern Europe. They are survivors of a group which was widely distributed during the Tertiary period over the greater part of the world (exclusive of Australasia and South America), some of the members of which, like the huge *Testudo gigas* of the Siwalik Hills of northern India, greatly exceeded in size any of the existing species. The earliest representative of these great tortoises was *T. ammon* of the lower Tertiary formations of the Fayum district of Egypt, a descendant of which is probably to be found in the greaved tortoise of the Sudan, referred to in an earlier chapter. The latter species is, indeed, to all intents and purposes a giant tortoise, although it differs from the Mascarene and Galapagos species in its brown colouring. Whether the Mascarene and the Galapagos tortoises are both the descendants of giant species, or whether they were independently derived from species of ordinary size, is a question to which it is almost impossible to give a satisfactory answer. It is equally difficult to account for the extermination of giant tortoises (with the exception of the aforesaid Sudani species) from the continents of the world, as such heavily armoured creatures have apparently little or nothing to fear from other animals, and are not likely to have been starved by the competition of more specialised types.

At the time that they abounded on all the islands of the Mascarene group these tortoises formed a valuable food-supply for passing vessels; and many of them were transported from their native islands to other parts of the world, where representatives of species that were otherwise extinct have survived to the present day. This has, of course, caused great confusion and difficulty in regard to the proper habitat of some of the species. From Madagascar giant tortoises seem to have disappeared long before the historic period.

Of the Mascarene species, one of the largest is Marion's tortoise (*T. sumeirei*), of which five living specimens were carried from their original island home by Marion du Fresne to Port Louis in the Mauritius in the year 1766. The largest of these, which was taken over with the barracks at Port Louis when Mauritius was ceded to England in 1810, and was then believed to be at least a century old, was living a few years ago in the Artillery Barracks at that port, but was nearly blind. Marion du Fresne obtained, it seems, his cargo of giant tortoises from the Seychelles, which may accordingly be regarded as the rightful home of *Testudo sumeirei*. Curiously enough, a tortoise, *T. gigantea*, which was originally a native of North Aldabra Island, survives at the present day only in the Seychelles, where examples are kept by the planters in a half-domesticated condition. The shell of one of these giants measured just over 52 inches along the curve and 40¼ inches in a straight line; the transverse diameter across the curve being 50 inches, and the weight of the whole reptile 358 lbs. South Aldabra, on the other hand, still retains—or, at all events, did so a few years ago—its particular species of tortoise, namely *T. daudini*. The largest known specimen of this species—and in fact the largest example of the whole group which has been seen alive—measured at the time of its death 67½ inches over the curve of the shell and 55 inches in a straight line, while its weight was no less than 560 lbs. From its original home this monster had been carried—it is said a century and a half ago—to Egmont Island, in the Chagos group, whence it was transported to England. Rodriguez was inhabited by *Testudo vosmæri*, a species long since extinct, and characterised by the extreme thinness and compressed form of its shell, features recalling the saddle-backed *T. ephippium* of the Galapagos Islands.

Van Neck, the discoverer of the dodo, saw vast numbers of these tortoises when he visited Mauritius in the year 1598; and they must have been equally numerous in Réunion, where one of the early voyagers mentions having killed a couple of dozen under a single tree in one afternoon. According, however, to Leguat, they were most numerous in Rodriguez, where there seem to have been two species in addition to the aforesaid *T. vosmaeri*.

Little is known with regard to the habits of the Mascarene tortoises in a state of nature, although it is probable that these were very similar to those of their Galapagos cousins, of which a full and interesting account is given in Darwin's *Voyage of a Naturalist*.

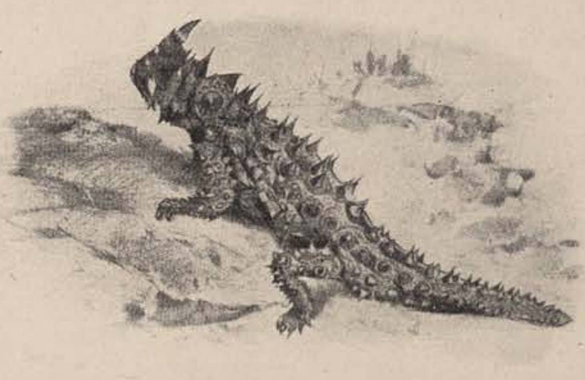
In regard to South Albemarle and its tortoises, a German explorer has written as follows:—"The island is an atoll [a ring-shaped coral-island] cut through in three places, with a greatest length of about 20 miles. The chief hindrances in the search for the tortoises is the impenetrability of the island. The soil consists entirely of sharp, water-worn corals, with their points uppermost, while the whole is covered with such thick masses of low scrub that a way has to be cut with an axe, so that an extended search over a large area is out of the question. To land on the outside is dangerous, on account of the heavy surf; while landing from the inside of the atoll is much hindered by the dense thicket of mangrove-trees. . . . Thousands of mosquitoes prevent one remaining over night in those places which the tortoises frequent. Then at last, when one has discovered, by a stroke of luck, one of the creatures in the thick scrub where they hide during the heat of the day, the real hard work begins, namely the conveyance of the reptile to the shore. Six reached Europe alive: two of them were sent to Frankfort, and the four others to Hamburg."

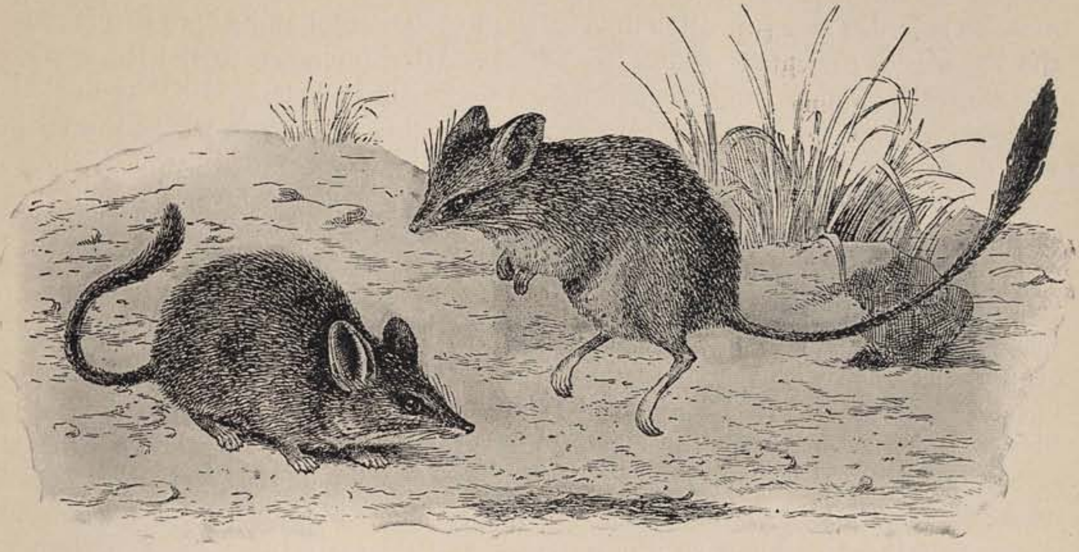
Land-Molluscs.

The land-molluscs of many of the islands of the Mascarene Province possess features which render them as a whole very markedly distinct from those of both Africa and Madagascar. Malagasy affinities, as might naturally be expected, are most pronounced in the case of the Comoros, where we find the genus *Cyclostoma* strongly developed, and but one of *Achatina* (see the chapters on the faunas of Ethiopian Africa and Madagascar). The genus *Ennea*, in which the shell is of an elongated spiral form recalling *Pupa*, is very characteristic of the Comoros, where it is represented by at least fifty species. The very remarkable small snails known as *Cycloturus*, belonging to the operculated family *Cyclophoridæ*, and in which the coils of the shell are disconnected, are absolutely peculiar to this group of islands, where the typical snails (*Helicidæ*) are but poorly developed.

In the Mascarenes proper the percentage of peculiar species of land and fresh-water molluscs is very high, and is paralleled only in some of the West Indian Islands. Some years ago it was recorded that of these peculiar species Mauritius had one hundred and thirteen, Réunion forty-five, and Rodriguez twenty-three. This seems indicative of long insulation; but, apart from these peculiar types, the molluscan fauna of the group exhibits Malagasy, Indian, and Australasian affinities. The most abundant peculiar generic type of land-snail is *Pachystyla*, belonging to the family *Naninidæ*, and confined to the Mascarenes, exclusive of the Seychelles. The most peculiar and characteristic type is, however, the carnivorous genus *Gibbus*, so named from the irregular and humped form of the conical and big-mouthed shell; it is most abundant in Mauritius, and represented by the allied *Edentulina* and *Streptostele* in the Seychelles. The presence of *Cyclostoma*, most of the Mauritian species of which are extinct, affords the strongest evidence of the affinity of the molluscan fauna of these islands with that of Madagascar. On the other hand, some eleven genera, of all of which the names need not be particularised, are indicative of relationship with the Indian and Australian regions, none of them occurring in Madagascar. Most interesting of all is the presence of the genus *Hyalimax*, elsewhere known only in the Andamans and Nicobars, and thus affording strong evidence of a former land connection between the Mascarenes and India by way of these islands.

AUSTRALASIA AND POLYNESIA





JERBOA POUCHED-MOUSE.

CHAPTER I

AUSTRALIAN AND TASMANIAN ANIMALS

TAKEN as a whole, the fauna of Australia and Tasmania differs so remarkably and essentially from that of the whole of the rest of the world that there can be no hesitation in regarding these islands as the typical representatives of a distinct zoological realm—the Notogæa of geographical zoology—the nearest affinities of which, if extinct forms be taken into consideration, appears to be with the South American realm, or Neogæa. That New Guinea, or Papua, although it contains animals more nearly related to those of Asia, should be included in the same realm, is beyond doubt. The difficulty is where to draw the line separating the Australian realm from the Oriental or Indian region, forming the most eastern portion of Arctogæa, the realm including all the countries of the world not comprised in either Notogæa or Neogæa.

In the original scheme of geographical zoology, as formulated by Messrs. Sclater and Wallace, the pioneers in this branch of science, the island of Celebes and the smaller islands of Timor and Flores were included in the Australasian realm, or region, the western boundary of which was drawn between Celebes and the smaller adjacent island of Lombok. The channel dividing these two islands was then believed to be of unusual depth; and this eastern limit of the Australian realm became universally known as "Wallace's line." Later researches have tended to throw doubts on the propriety of including Celebes in the Australian realm, and a Dutch naturalist, writing in 1909, from a study of the mammals, amphibians, and fresh-water fishes—which afford some of the most trustworthy and valuable evidence on this subject—has declared that Wallace's line "has no value as a zoogeographic boundary," and that nearly the entire eastern half of the archipelago must be regarded as a transition area between the Oriental and Australian regions, the boundaries of which cannot be defined. After reference to the theory that the Australian fauna came from South America, it is concluded "that in post-Cretaceous times (that is to say, the epoch succeeding the one in which the chalk was deposited, or, in other words, the Tertiary period) there was a broad connection between the three Greater Sunda Islands—Java, Borneo, and Sumatra—and the mainland of Asia on the one hand, and between New Guinea and Australia on the other; and that between the Sunda Islands and New Guinea a connection must have existed, which was really less easy to pass over." Celebes is considered to possess an impoverished Indian fauna, due to the absence of free connection with the larger western isles, this poverty being most noticeable in the case of fishes. Its fauna may be the result of the consolidation of smaller islands, which were supplied by feeding lines from islands to the south, north, and east. "It is strange that the truly Indian character of Celebes remained unsuspected so long; while, on the other hand, no one doubted, but rather laid stress upon, the Australian relationship of that vast easterly island, New Guinea, the fauna of which is fully as Indian as that of Celebes is Australian."

Taking, then, New Guinea and some of the smaller islands in its neighbourhood as the western limits of the Australian realm, reference may be made in the first place to some of the physical features of Australia and Tasmania, which form the typical portion of that realm. As regards Australia itself, the coast-line in the neighbourhood of Cape York lies within the limits of the tropical rain-belt; while a strip of coast trending in a southerly direction from Brisbane almost to the latitude of Melbourne is likewise included in the rainy zone, as is also Tasmania. In north-eastern Australia the rain-belt follows the line of the coast to die out among wooded and then grassy plains. We then come upon a desert tract extending along the southern border of the Great Australian Bight, and thence following the coast in a north-westerly direction till the West Australian area of hard-leaved trees is reached. Over a part of the western border this expands into a kind of semi-desert, which includes nearly one-half of the entire continent. Although the vegetation of the rain-belt is less luxuriant than that of the Malay Islands, yet, allowing for the difference in the species to be met with in the two areas, there is a very considerable resemblance. On the other hand, that portion of the rainy area which lies within the southern temperate tract on the south-eastern coast of Australia and including Tasmania is of an altogether characteristic and peculiar type, this being especially the case with the wooded ravines of Victoria, locally known as fern-gullies, which owe their wonderful luxuriance more to moisture in the ground than to that which falls from above. In this area the forest over extensive tracts is divisible into distinct zones, of which the uppermost is in some instances composed of closely approximated eucalyptus trees, while in others it consists of more widely separated trees of the same group, some of which tower to a height of between 250 and 350 feet. The tree-ferns of the lower zone do not, on the other hand, exceed a height of from 35 to 45 feet. It should be added that ferns recalling in general appearance the European *Osmunda*, or royal fern, often cover the ground over large tracts of the forest:

while smaller kinds frequently trail as parasites over the stems of the tree-ferns. One of these beautiful climbing species, commonly known as the creeping-fern (*Polypodium scandens*), forms a huge network over the giant stems of that magnificent forest-tree the Australian evergreen beech (*Fagus cunninghami*), on which it often ascends as high as the leafy crown. Clinging closely to these trees, the creepers grow with the greatest luxuriance, till high up in the mass of foliage they stretch in graceful festoons from one to another. In other districts of the rainy zone, as in parts of Victoria, another climber, the tetrarena, waves in dense masses from the eucalyptus-trunks, or hangs from the leafy tops of other trees to form a green wall between the shrubs, or to bridge the gaps between the stately tree-ferns. On the ground a peculiar kind of grass often covers large tracts, concealing the fallen trunks of the gum-trees, and forming an impenetrable cushion, or making bridges over deeply sunk ravines, through which flow the forest-streams.

Very different from the eucalyptus forests of Victoria and other districts of southern Australia is the so-called "scrub," formed by the hard-leaved vegetation of the south and south-west. This scrub, which occurs under very varied conditions, and covers one-eighth of the northern and eastern districts, consists chiefly of evergreen shrubs, although it also includes some dwarf trees. Many fine gum-trees struggle with the other occupants of the soil for existence. The scrub varies much in height, although averaging from 4 to 5 feet, its prevailing colour being a uniform bluish green, broken here and there by white, reddish brown, or vivid green. In many places it consists of only one kind of eucalyptus, which grows to a height of about a dozen feet, although elsewhere recalling the evergreen forests of the Mediterranean countries. It is, however, unusually rich in species of plants, which, though superficially alike, present either in flower or fruit immense variety; and it should be studied at all seasons, since every month some tree or shrub is in bloom. The rainy season, which has but little influence on the flowering of the woody vegetation of the bush, is, however, poorest in flowers, which are most abundant in the early part of the dry season, from September till November.

Far more pleasing than the scrub are the wooded plains, the home of the magnificent eucalyptus trees of the driest districts of the island-continent. A striking feature is the pale blue colour of the leaves of these forest giants, which in their leathery texture recall those of evergreen shrubs. In every respect these trees are admirably adapted to a hot climate of intense dryness; and they exhibit special modes of growth at different ages in order to receive the maximum amount of light. These splendid eucalyptus forests cover not only a large part of the coast-districts of South Australia and Queensland, but reappear in Tasmania. They are densest in districts where underground water is present and on the banks of rivers; and they cover the greater part of the lower mountain regions and their slopes, so that they may be regarded as peculiarly characteristic of the Australian flora. At regular, and often equal distances these forest giants either stand alone or in small groups, as if planted by a landscape gardener; and the tops of these gum-trees never touch those trees of other kinds.

These eucalyptus forests extend to the rolling plains, which form a grass-country, partially covered with low bushes, and dotted with an occasional straggling, stunted tree. Portions of the mountain slopes are also grassy, without a single tree or bush. In South Australia the grassy tracts attain their fullest development, occupying the greater part of the country, and extending north and east from the coast in an undulating plain for hundreds of miles into the interior. On the cultivated portion of these plains is grown some of the best wheat in the world. In January the grassy tracts look like dry, ripe cornfields, and remain in this parched condition till the commencement of the next rainy season, when the plains, as if at the touch of a magician's wand, once more clothe themselves afresh in verdure; the welcome moisture transforming the straw-like grass so quickly that, after only two days' rain, the whole expanse becomes as green as an English meadow in spring. At the same time many plants burst into blossom; and every week brings out fresh colours, such as the brilliant scarlet of the kennydias, the full violet of the swainsonias, and the variously twisted heads of the basket-flowers.

As regards other vegetation, it must suffice to refer to the graceful, cypress-like casuarinas, which form such a characteristic element of the Australian flora.

Of the mammalian fauna of Australia and Tasmania the great feature is the presence of the egg-laying, or monotreme, group, the great development of marsupials, and the complete lack of all the placental groups with the exception of a certain number of bats and of rodents belonging to the mouse family (*Muridæ*); the dingo, or native dog, being, like its master, an importation from the west. Egg-laying mammals are entirely restricted to the Australasian realm, while marsupials are found elsewhere at the present day only in Central and South America.

The Australian and Tasmanian Natives.

The black-skinned natives of Australia, who have features approximating to the Negro, or perhaps to a low, generalised type, although their skulls are different, were formerly supposed to represent a hybrid race due to the fusion of Eastern Negroes with a primitive stock of the Caucasian group—that is to say, the group to which the natives of western Europe and the Indian Aryans belong. It is, however, more probable that they are really low-grade Caucasians, akin to such tribes as the Veddas of Ceylon, the Toalas of Celebes, and the Ainus of Japan; such Negro-like characters as they possess being due to inheritance from a common stock, and in some degree to secondary variation. Australians are characterised by their physical uniformity, which is an indication of their being a pure-bred type, and they probably reached their present home from Asia. The broad and squat nose, with a low bridge and the nostrils open, is a Negro feature, but these characters are exaggerated owing to the use of a nose-peg. The prominence of the jaws is also Negro-like, although the large size of the jaws and teeth may be an acquired secondary character due to hard food. The deep notch above the bridge of the nose and the sunken eyes, which form the most striking characteristics of Australians, may likewise be secondary adaptations to the glare of the sandy plains on which they dwell. Unlike Negroes, Australians are extremely hairy, the hair on the head being waved and long, the beard full, and the body in some instances so hairy that the covering resembles a thin fur. The shape of the head also differs from that in the Negro, the forehead being high and the cheek-bones prominent. The idea that

Australians are the lowest of mankind is erroneous, for in mental characters they approximate in many ways rather to the Caucasian than to the Negro standard.

On the other hand, Tasmanians, now extinct, seem to have been members of the Melanesian or Asiatic group of Negroes, the features in which they depart from the original type being apparently the result of isolation, and not of crossing. Negro characters are shown in the form of the nose and nasal bones, the thick, projecting lips, the large teeth, and the tufted, frizzly, and elliptical hair. As in Australians, the last upper molar, or "wisdom-tooth," has three roots—a feature rarely seen in higher races.

DINGO.

Dingo. As the native dog or dingo appears to be also an immigrant into Australia, it may appropriately be referred to in connection with its masters, with whom it probably travelled from Asia. Dingos are nearly related to the pariah dogs of southern Asia and eastern Europe, as well as to the half-wild tengera dogs belonging to certain tribes in Java. It is true that fossil skulls and bones of the dingo have been found in association with those of extinct Australian marsupials, but since these belong to a period when man was already in existence in other parts, there seems no reason why he should not have reached Australia at this date. Although the dingo was long regarded as a species by itself, and named *Canis dingo*, these considerations lead to the conclusion that it is not specifically distinct from the domesticated dogs of other parts of the world, and, if entitled to a scientific title, should accordingly be known as *C. familiaris* *dingo.* If this animal was not introduced by man, its occurrence in the native Australian fauna, which includes no Carnivora, is simply inexplicable.

In this connection it is specially worthy of note that Australian natives are extremely fond of their dogs, and are adepts in rearing and training them. When a native finds a litter of wild dingo puppies (for many of these dogs are completely wild), they are carried to his hut, where they are as carefully brought up as the children. In all cases these dogs are allowed to sleep in the huts, where they are fed partly on meat and partly on fruit, and, as a rule, they are merely scolded, and not beaten, for misbehaviour. Despite their imperfect training, they will only obey their own master. They are used to guard the flocks and protect them from the attacks of other dogs, and are adepts in tracking kangaroos and other native animals, some of which they are able to run down.

Wild dingoes are shy animals, which hide themselves by day, and hunt for food at night, usually in parties of not more than four or five. Sometimes, indeed, a pack numbering from about eighty to a hundred will collect, but in most cases only females and their offspring are seen together, such family parties having well-defined territories, that they themselves do not leave, and which they do not permit other dingoes to enter. As a rule, the female produces from six to eight puppies in a litter, but, in spite of their rapid rate of propagation, wild dingoes have already disappeared from many parts of Australia. In the more thickly populated parts of the country pure-bred dingoes are difficult to obtain, as these animals pair freely with other dogs. In general colour dingoes vary from foxy red to blackish, the bases of the long hairs being blackish in the darker varieties, but generally yellow or white in those of lighter colour. The head and back are usually dark yellowish red, frequently mingled with black, the under-parts are lighter, and may be white, as is invariably the case with the tip of the tail, and in some instances also the paws, but the muzzle is usually black. Although there is considerable individual variation in regard to size and shape, the dingo is generally a long-limbed dog, with a long and somewhat bushy tail, a broad muzzle, and upright ears relatively rather smaller than those of a wolf. The range of the dingo is restricted to the Australian continent, throughout which it was to be found half a century ago.

Bats. The bat-fauna of Australia is not numerous, and evidently reached the country by way of the Malay Archipelago, as the majority of the species are of an Asiatic type. This is well exemplified by the occurrence in the wooded district of immense colonies of flying-foxes of the typical genus *Pteropus*, which is represented by five species, namely, *P. brunneus*, *P. gouldi*, *P. conspicilatus*, which ranges into New Guinea and the neighbouring islands, *P. poliocephalus*, and *P. scapulatus*; the last of these being characterised by the narrowness of its molar teeth. Fruit-bats are also represented by two species, *N. robinsoni* and *N. papuanus* of the curious tube-nosed bats forming the Austro-Malay genus *Nyctimene*, the second of the two being common to New Guinea. To the westward the bats of this genus are known to range as far as Celebes and Timor, while to the east they inhabit the Solomon islands. In Australia they are restricted to the tropical forest belt of Queensland, forming the north-east corner of the continent, and the fauna of which is closely related to that of New Guinea.

The ancestral forms of the group were no doubt immigrants from the Austro-Malay Archipelago. The purport of the oblique tubes into which the apertures of the nostrils are prolonged still remains unknown, but it is noteworthy that other bats of the Cynopterine section, to which the tube-nosed group belongs, exhibit an imperfect development of the same feature. The only other Australian fruit-bat is *Syconycteris australis*, a member of a genus with two other species, the collective range of which includes the Moluccas, and New Guinea and the neighbouring islands. It is nearly related to the Asiatic *Carponycteris* or *Macroglossus*, and restricted to Queensland.

Of insectivorous bats the list is very short. It includes the Australian golden bat (*Rhinonycteris aurantia*), the sole representative of a peculiar genus of the nose-leaved family, *Rhinolophidæ*; while the great false vampire (*Megaderma gigas*) of central Queensland is a member of an Asiatic genus of the family *Nycteridæ*, notable on account of being the largest of all the insect-eating group. In the family *Vespertilionidæ* the typical section of the genus *Chalinolobus* is restricted to Australasia and New Zealand, where it is represented by *C. morio*, common to Australia, Tasmania, and New Zealand, and several other species peculiar to Australia. Very noteworthy is the occurrence in Australia, as well as in Madagascar, of bats which are best regarded merely as local races of Schreiber's bat (*Miniopterus schreibersi*) of Europe and Asia.

Rodents.

Apart from bats, the only indigenous Australian land mammals other than marsupials and monotremes are rodents of the family *Muridæ*, of which there is a considerable number of specific representatives, belonging for the most part to peculiar generic or subgeneric groups. In making this statement it must be understood that introduced European and Asiatic rats and mice do not enter into consideration. A considerable number of the Australian rats and mice have been generally included in the typical genus *Mus*, but the generic separation by more advanced naturalists of European groups typified by the black rat, the wood-mouse, and the harvest-mouse has entailed a similar sundering of the Australian species, which are referred to several genera. Referring to these under their original generic designation, mention may be made of the brown-footed Australian rat (*Mus fuscipes*), notable on account of the similarity between its habits and those of the water-rat of Europe. A Tasmanian species, *Mastacomys fuscus*, commonly known as Lichtenstein's rat, is the sole representative of a well-marked genus distinguished from *Mus* and its subgenera by the greater width of its cheek-teeth, of which it has only four pairs in each jaw. Other rats belong to the genus *Uromys*, which contains several species of which the collective range extends from Queensland to the Arru Islands, with a single outlying representative in the Solomon group. All these rats differ from *Mus* by the scales in the skin of the tail forming a kind of mosaic work, with their edges in apposition, instead of one overlapping the other. Highly characteristic of Australia are the jerboa-rats, of which there is a considerable number of species, formerly all included in the genus *Conilurus*, or *Hapalotis*, but now split up into four generic groups. The first of these is *Notomys*, represented by *N. mitchelli*, *N. cervinus*, and *N. longicaudatus*, in all of which the cheek-teeth are practically similar to those of ordinary mice and rats (*Mus*), but the hind-feet are much elongated, with only three or four bare pads on the under surface. *Leporillus*, with the species *L. apicalis* and *L. murinus*, differs in retaining, like the two remaining genera, the normal six pads on the soles of the hind-feet. *Ammomys*, as typified by *A. hirsutus*, and *Conilurus*, with *C. albipes* and *C. penicillatus*, are, on the other hand, chiefly characterised by details in the structure of the skull and teeth. These rats, which are restricted to Australia and Tasmania, resemble jerboas in general appearance, having long tails and ears, and much elongated hind-legs, by means of which they are specially adapted for a desert life.

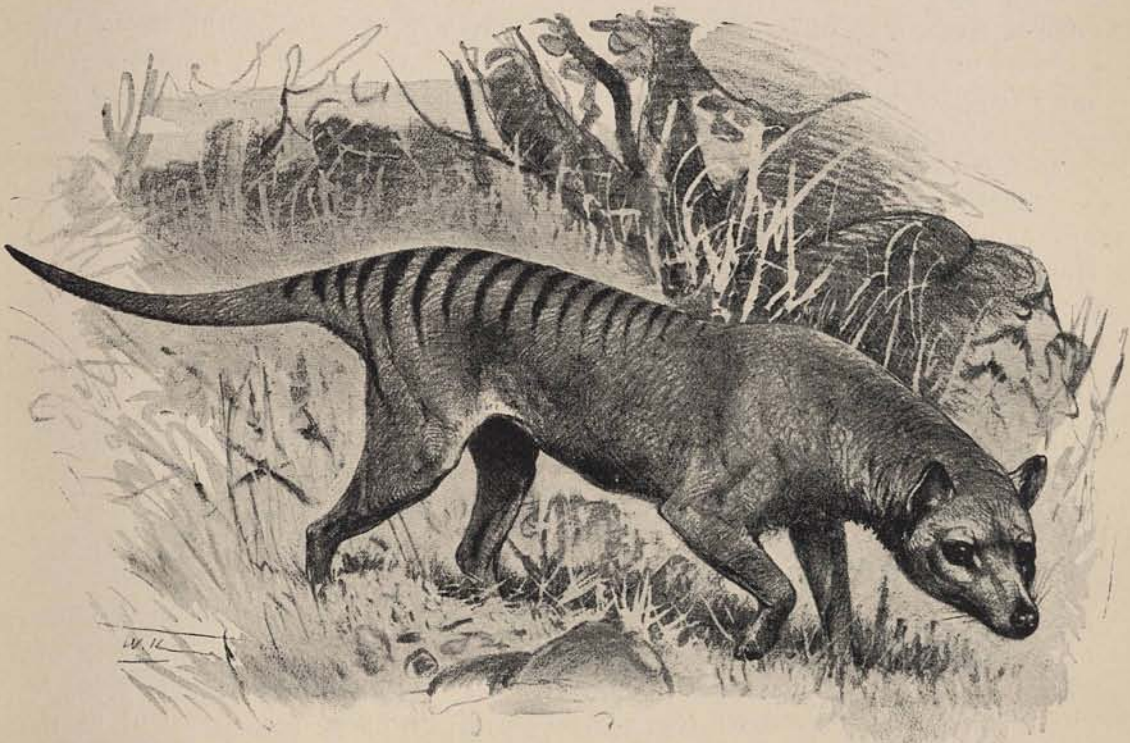
This does not, however, by any means exhaust the list of Australian *Muridæ*, since both Australia and Tasmania, as well as New Guinea, are inhabited by a large and strikingly coloured species known as the golden-bellied water-rat (*Hydromys chrysogaster*), typifying an exclusively Australasian genus. This handsome rat, which measures about 24 inches in length, with the tail forming nearly half, is blackish above and golden yellow below, while the tail is dark with a flesh-coloured tip. The nostrils are concealed amid the thick fur of the muzzle, and the broad feet are webbed, the hind pair being larger than the front ones, and also having larger claws. This rat, which generally frequents the banks of rivers, but at times resorts to the sea-coast, forms, with an allied species, the typical representative of an Australasian subfamily of the *Muridæ*, distinguished by the reduction of the cheek-teeth to a couple of pairs in each jaw. The second generic representative of this group is the Queensland rat (*Xeromys myoides*), a species about double the size of an ordinary mouse, with no webs to its toes, and leading a life on land.

Tasmanian Wolf.

Leaving placental mammals, attention may be directed to that very remarkable animal known to the colonists of Tasmania as the native wolf, but very generally termed by naturalists the thylacyne, or thylacine, —an Anglicised form of its scientific designation, *Thylacynus cynocephalus*, the literal translation of which is "the pouched dog with a wolf-like head." This indicates that the animal is a member of the marsupial or pouched order of mammals. So wolf-like, however, is the general appearance of the thylacyne that it is frequently difficult to convince persons who have not received a zoological training that the animal is nearly related to kangaroos and wombats, and not a cousin of the wolf. Close examination of its external appearance ought, however, to convince such sceptics that the thylacyne is not a wolf. For it differs from dogs and wolves, and placental mammals in general by the remarkable circumstance that its tail, instead of forming a distinct appendage, is very thick at the base, and seems to pass almost imperceptibly into the hind-quarters, so that it appears to form a part of the body. In this respect the Tasmanian wolf approximates to crocodiles and other reptiles; and there is, indeed, strong reason to believe that this peculiarity in the conformation of the tail—paralleled in the case of the African aard-vark, which, although not a marsupial, is also an animal of low and primitive type—is a direct inheritance from reptilian ancestors. The transverse dark barrings are also quite unknown in any member of the dog and wolf family, but are found in certain other members of the marsupial order, such as the Australian banded anteater and the South American water-opossum.

As a matter of fact, the marsupials of Australia, which have been long isolated from all other mammals save the above-mentioned bats and rodents, have had to play the parts which in other regions are shared by various groups of the higher placental mammals, and have consequently developed herbivorous and carnivorous, terrestrial and flying, leaping and walking, and also burrowing types, although, strange to say, none of them has taken to an aquatic mode of life. The Tasmanian wolf and its relatives represent the carnivorous and more primitive type of marsupial life; the herbivorous and leaping kangaroos, together with the burrowing wombats, forming a later and more specialised development.

There is good reason to believe that marsupials are descended from a group of ,small species of arboreal habits, to which the American opossums approximate more closely than do any other existing members of the order. Where these primitive ancestors originated is not yet definitely known, although, as suggested above, Ethiopian Africa may have been their birthplace.



THE TASMANIAN WOLF.

The young of marsupials, it is almost superfluous to remark, are born in an exceedingly imperfect state of development, and look like tiny animated bags of fat more than mammals. By means of special structural peculiarities, the nature of which need not now be discussed, they affix themselves to the teats of their parents, to which they adhere by their mouths as if glued. In most cases they are protected by being enclosed in the pouch of skin from which the marsupial order takes its name, but in certain cases this structure has disappeared. In the case of the thylacyne, four of these little abortions, as they may be called, are produced at a birth, when, despite the size of their parents, they are no bigger than young rats. Young marsupials are transferred to the pouch by their mother taking them, as soon as born, in her mouth; and many of them return to this warm nursery at intervals when they are of such an age as to be able to run by the side of their mothers.

The thylacyne, which is the largest living member of the carnivorous group of marsupials—the polyprotodonts, as they are termed by naturalists, from the relatively large number of their incisor teeth—has been generally included by naturalists in the family *Dasyuridæ*, typified by the so-called native cats of Australia, but by American naturalists it has of late years been made the type of a distinct family, the *Thylacynidæ*, the other members of which are extinct, and are known by skulls, teeth, and bones from the middle Tertiary deposits of the Santa Cruz district of Patagonia. If, as seems to be the case, these extinct carnivores, such as *Prothylacynus*, are rightly associated with the Tasmanian wolf, it is a most remarkable fact in the geographical distribution of animals, and affords practically conclusive evidence that Australia and Tasmania were at one time connected with one another by land. The fact that the nearest living relatives of the Tasmanian wolf and the native cats of Australia are the true opossums of South America (of which one or two have made their way north of the Isthmus of Panama) affords corroborative evidence in the same direction.[1]

To describe the thylacyne on the present occasion would be quite superfluous, and it must accordingly suffice to state that fossil bones and teeth preserved in formations of late Tertiary age indicate the former occurrence of this or a closely allied animal on the Australian mainland. On account of its sheep-worrying propensities the thylacyne has been relentlessly persecuted by European farmers in Tasmania, where it has been driven to the mountains, and even there is now becoming comparatively scarce, although it was once common all over the island. Thylacynes do not bark, but utter a mournful kind of whining cry.

Tasmanian Devil. Still more mischievous and destructive is the smaller animal which has been branded by the settlers with the opprobrious title of Tasmanian devil. If the thylacyne be regarded as representing a family group by itself, the Tasmanian devil (*Sarcophilus ursinus*, or *S. satanas*) will be the largest living member of the *Dasyuridæ*. In its thick and clumsy head, broad and shortened muzzle, and large, rounded ears, this cordially detested animal distantly recalls a very small bear, although the resemblance is marred by the presence of a thick tail of medium length. On the other hand, bear-like characteristics are displayed in the animal's gait and general movements, as well as by the circumstance that the body stands somewhat higher in front than behind. In colour the thick close fur is, as a rule, uniformly black or blackish brown, although there are usually a pair of white spots on the neck, and others on the shoulders and at the root of the tail. In size the Tasmanian devil may be roughly compared to a badger. As in that animal, its teeth and jaws are immensely powerful, the molars approximating in structure to those of the thylacyne, although of an altogether more massive character, and with a different arrangement of their cusps; in both species they are strikingly different to those of any placental carnivore. The distribution of the Tasmanian devil is precisely similar to that of its larger cousin, both at the present day, and in a past epoch. It is very noteworthy that remains of the Tasmanian devil have been found on the sandhills near Warrnambool, Victoria, in association with bones and teeth of man and other mammals; the occurrence of the species on the Australian mainland at a very recent epoch being thereby conclusively proved. Although in places where they are numerous these animals are accountable for the destruction of great numbers of sheep, as well as other large mammals, they do not disdain a diet of insects. Shunning the light, and sleeping through the day in caverns or clefts among rocks, or in holes excavated under the roots of trees by their own powerful claws, these animals seem dazed and blinded if dragged into the full glare of the sun. In disposition they are fierce and morose, greeting those who disturb them in their mountain haunts with loud snarls and growling.

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[1] The writer may be permitted to take the opportunity of mentioning that this view—based on recent increases in our knowledge—is to be taken as replacing opinions previously expressed by himself on this point.

TASMANIAN DEVIL.

Native Cats. On the smaller members of the *Dasyuridæ*, some of which are found both in Australia and Tasmania, the settlers have bestowed the exceedingly inappropriate name of native cats, as there is nothing cat-like about them, with the exception that they are carnivorous. On the contrary, they have slender, sharp muzzles, pointed ears, and long, thickly haired tails. The largest of the group is the spot-tailed dasyure (*Dasyurus maculatus*), which ranges from the central districts of Queensland to Tasmania; but a better known species is *D. viverrinus*, the range of which does not extend farther north than the eastern watershed of New South Wales.

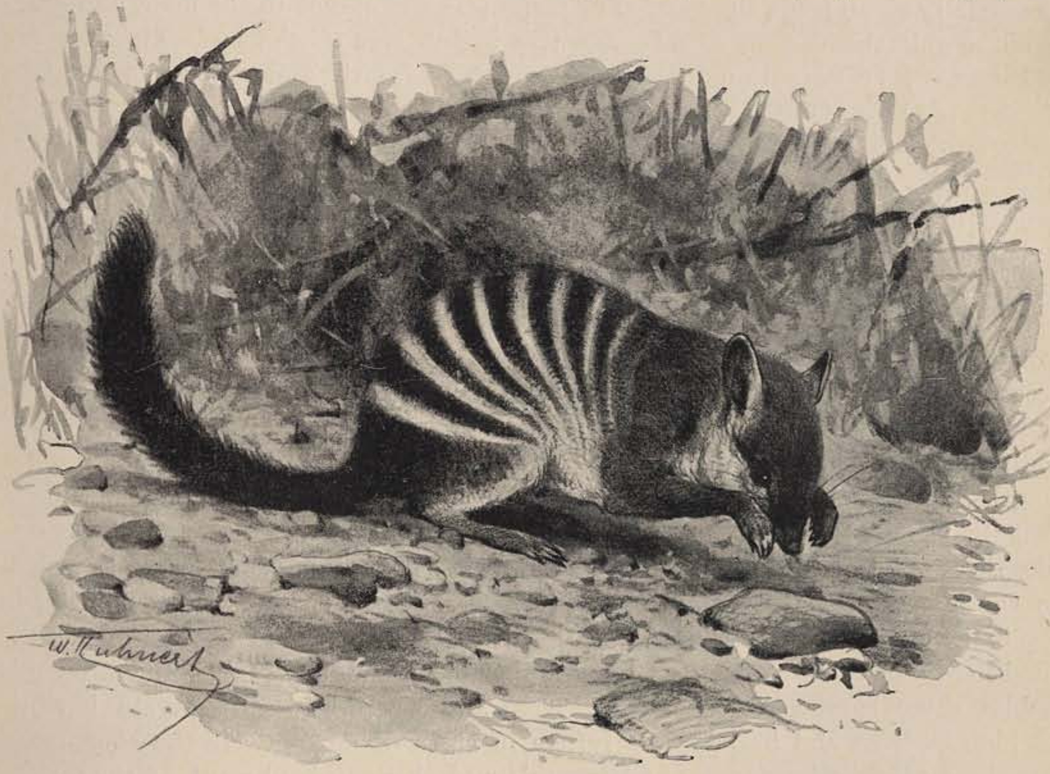
Pouched Mice. Smaller still are the pretty little marsupials commonly known as pouched mice, of which there are numerous representatives. These marsupials have pointed, rather long tails, large, round, naked ears, and short, broad feet, with a nailless, although distinct first hind-toe. The tail is sometimes bushy throughout, sometimes nearly bare, and occasionally crested. In habits pouched-mice resemble the tupais, or tree-shrews, of tropical Asia, dwelling in the branches of trees, where they obtain their insect-food, and in the holes of which they make nests for themselves and their numerous young. Pouched-mice may be divided into two groups according to coloration and habitat, the exclusively Papuan species having a stripe along the line of the back, which is wanting in the other members of the group. A well-known kind is the yellow-footed pouched-mouse (*Phascologale flavipes*), which ranges from New Guinea to South Australia, but is unknown in Tasmania. Another kind, also unknown in the last-named island, but ranging over the whole of the Australian continent, is the brush-tailed pouched-mouse (*P. penicillata*), an animal somewhat larger and more strongly built than the yellow-footed species, with bigger ears, and the tip of the tail evenly tufted instead of short-haired.

Narrow-footed Pouched-Mice. Nearly allied are the narrow-footed pouched-mice, which are confined to Australia and Tasmania, and, unlike the members of the preceding group, never ascend trees. Some of the species resemble ordinary pouched-mice in possessing ten teats, and are thus able to rear a large progeny. The females of the common narrow-footed pouched-mouse (*Sminthopsis murina*), a species inhabiting all Australia, have, however, only eight teats. This animal is about 7 inches long, inclusive of the tail, which is equal in length to the head and body. The longest kind, *S. virginiœ*, known as yet only from Queensland, measures about 10 inches from the head to the tip of the tail.

Dasyuroides. From central Australia has been obtained a small marsupial which is to a great extent intermediate between the typical and the narrow-footed pouched-mice, and has therefore been referred to a separate genus, under the name of *Dasyuroides byrnei.* With the exception of the tail, it presents a marked general resemblance to the pouched-mouse known as *Phascologale cristata*, but is of larger size and stouter make, and lacks the first toe of the hind-foot, while in shape this foot is different from that of either of the allied genera.

Jerboa Pouched-Mouse. Of quite a different type is the elegant and graceful little creature known as the jerboa pouched-mouse (*Antechinomys laniger*), which is the sole member of its genus. In addition to the great elongation of the hind-limbs, to which it owes its English name, this species is characterised by the absence of the first hind-toe, as well as by the long and pointed form of the muzzle, the oval ears, and a tail considerably longer than the head and body. In habits it is singularly jerboa-like, and in distribution is restricted to New South Wales and Queensland.

It has been suggested that the leaping habits of this species, like those of the Australian jerboa-rats, are a special adaptation to a life in dry sandy districts. In the *Report of the Horn Expedition to Central Australia*, it has, however, been pointed out that it is difficult to see what particular advantage is gained by this mode of progression. The country where they are usually found is dotted with big tussocks of grass and shrubs; and in the case of larger animals, such as kangaroos, it is doubtless an advantage to be able to take these in their stride, instead of having to go round the obstacle. But neither the jerboa-mouse nor the jerboa-rats are able to accomplish this, on account of their smallness; and it is particularly noticeable that the creeping placental mice which frequent the same country appear to thrive just as well as their leaping compatriots; and so far as travelling over level ground is concerned, an ordinary mouse is just as well fitted to do this in the shortest possible time and to gain the shelter of a tussock of grass or a shrub when threatened by a hawk as is one endowed with leaping powers. On the other hand, it is quite conceivable that a small animal progressing by leaps and bounds may be much more difficult of capture by a swooping bird-of-prey.



THE BANDED ANTEATER.

Banded Anteater. One of the most interesting of all the small insect-eating Australian marsupials of the present section is the species known as the banded anteater (*Myrmecobius fasciatus*), a somewhat squirrel-like animal which alone represents not only a genus but likewise a special subfamily of the *Dasyuridæ*, if, indeed, it is not entitled to rank as the representative of a family of its own. Among its special characteristics are the absence of a pouch in the female and the unusually large number of its widely spaced and sharply cusped cheek-teeth. From the latter feature the marsupial anteater was long supposed to be a relative of certain small primitive mammals of which jaws and teeth are found in the Oolitic formations of England. These fossil jaws are likewise characterised by the unusually large number of their cheek-teeth; but the tendency is now to regard the presence of a similar feature in the marsupial anteater, not as an inherited primitive feature, but a secondary modification due to a kind of degradation.

In accordance with the large number of its cheek-teeth, the banded anteater has unusually long and slender jaws, and as its food consists chiefly of ants and other insects, the tongue, like that of other anteaters, is long, worm-like, and capable of being protruded far in advance of the muzzle. The shape of this animal is, as already mentioned, distinctly squirrel-like, and the coarse and bristly fur is white below and dark chestnut-brown above, marked on the back with several broad white transverse bands, or perhaps the coloration of this part might be better described as white with reddish brown bands. Although it will occasionally climb trees, the banded or marsupial anteater is in the main a ground-dwelling animal, choosing situations where hollow tree-trunks and ants' nests are abundant. Its distributional area embraces New South Wales and the southern districts of Queensland.

Bandicoots. The numerous species of Australian marsupials known as bandicoots, which are not to be confounded with the animals called by the same name in India, are carnivorous or insectivorous in diet, but have the second and third hind-toes very small and united by skin in the same way as in kangaroos and the Australian opossums. This resemblance between the hind-feet of the bandicoots and the *Phalangeridæ* is the more remarkable seeing that, apart from the fact that both are pouched mammals, no other signs of relationship have been detected between the two groups, in which the fore-feet are quite unlike. In bandicoots (*Peramelidæ*) the first and fifth front toes are almost or completely rudimentary, while the three middle ones, or at least two of these, are of uniform length and furnished with well-developed claws. A peculiarity in the skeleton is that the terminal bones of the larger toes in both pair of feet are cleft at the tips like those of pangolins. The more typical members of the genus are characterised by the clawless small first and fifth front-toes, the same feature also existing in the first hind-toe; and likewise by the difference in the length of the fore and the hind limbs not being so great as in the other members of the group. As regards habits, those species which are nocturnal and sleep by day excavate burrows as hiding-places and harbours of refuge in cases of danger. In the short-nosed bandicoot (*Perameles obesula*) of Tasmania and the mainland south of the tropics, the ears are short and rounded, the hair is mingled with short spines, and the soles of the hind-feet are completely naked; the length of the head and body being about 14 inches, and that of the tail 5½. A second division of the group is represented by Gunn's bandicoot (*P. gunni*), of Tasmania, which is about 16 inches in length to the root of the tail, the tail itself measuring less than 4 inches. In colour this species is grizzled yellowish brown above, and white or yellowish white below and on the chin, with four or more pale transverse stripes on the hind part of the back; while it is further characterised by the hairy posterior half of the sole of the hind-foot, and the length of the pointed ears, which if turned forwards reach the eyes.

Rabbit-Bandicoot. The two known species of rabbit-bandicoot take their name from the excessive length of their ears, other characteristics being the presence of a crest of long hairs on the terminal portion of the tail, the length of the legs, and the absence of the first hind-toe. Of the two species, the typical common rabbit-bandicoot (*Peragale lagotis*) is characterised by its long silky hair and peculiar coloration, the fur being delicate grey above, brownish on the flanks, and white beneath, the cheeks and feet being also white. The species is a native of South and Western Australia.

Pig-footed Bandicoot. A very remarkable type is the pig-footed bandicoot (*Chœropus castanotis*), which derives its name from the peculiar conformation of its feet; the first and fifth front toes being absent and the fourth rudimentary, while the second and third are furnished with slightly curved claws. In consequence of this structure the fore-feet present a superficial resemblance to those of a pig; while the hind ones are rather suggestive of those of a horse; the first toe being absent, the fifth hardly visible, the second very small and deformed, and the whole strength of the foot thus concentrated on the large and well-developed fourth digit. The pig-footed bandicoot is a slenderly built animal, measuring about 10 inches in length to the 4-inch tail, with long ears, a short but sharply tapering muzzle, naked at the tip, and coarse, straight, although not spiny, hair. This bandicoot, which inhabits the larger part of Australia with the exception of the extreme north, north-east, and east, lives by preference on open grassy plains where it builds a nest in holes. In colour it is uniformly grizzled yellowish grey above, with chestnut ears, and pale yellowish grey or yellowish white on the chin and under-parts.

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RABBIT-BANDICOOT.

Marsupial Mole. In the sandy wastes of central Australia the place occupied in Europe by moles and in South Africa by golden moles is filled by a silky-haired marsupial of about the same size as an ordinary mole, but of a pale golden red colour. This animal, the marsupial mole (*Notoryctes typhlops*), represents a family by itself, and forms the last group of the typical, or polyprotodont marsupials. To such a burrowing creature neither external ears nor eyes would be of any use, and we accordingly find that while the latter are deeply buried in the skin, the former have entirely disappeared. To protect the lips and nostrils when the animal is driving its tunnels through the sand, the muzzle is covered with a stout leathery shield. In walking, the marsupial mole rests on the outer sides of the fore-feet, and the claws of the third and fourth toes are in consequence unusually large and powerful; the corresponding toes in the hind-limbs curving outwards and backwards. The pouch opens backwards. With its feet, aided by the stumpy, ringed, and leathery tail, which appears to be pressed against the floor, the animal drives a triple sinuous track in the sand, the two outer lines of which are more or less interrupted. The marsupial mole inhabits the deserts of central South Australia, where rain falls only during a brief portion of the year, and is then quickly sucked up in the thirsty dunes and flats, sparsely overgrown with porcupine-grass (*Triodia irritans*) and acacias. Here it lives almost entirely beneath the surface, its galleries running at a depth of some 2 or 3 inches, so that it is often possible to track its course by the slight cracking or moving of the surface over the position of the underground miner. Above ground the creature moves slowly and heavily in a sinuous curve. It enters the ground obliquely; and the hind-limbs are employed to throw the sand backwards in such a manner as to fall in again behind the animal, thus leaving no permanent tunnel to mark the course. The colour of the marsupial mole almost exactly matches that of the sand in which the animal dwells.

The eye of the marsupial mole, despite the fact that its owner spends so much of its time on or near the surface of the ground, is much more completely atrophied than in the mole, the optic nerve and lens being wanting, while the other structures connected with vision are degenerated in a greater or less degree. The eye itself has sunk deep beneath the skin, which passes over it unaltered except for the presence of sensory organs developed from the lachrymo-nasal glands and ducts. This complete degeneration of the eye may be attributed to the irritating effects of the particles of heated sand amid which the creature dwells, the development of the glandular structures into sense-organs being in all probability a compensation for the loss of vision.

Kangaroos.

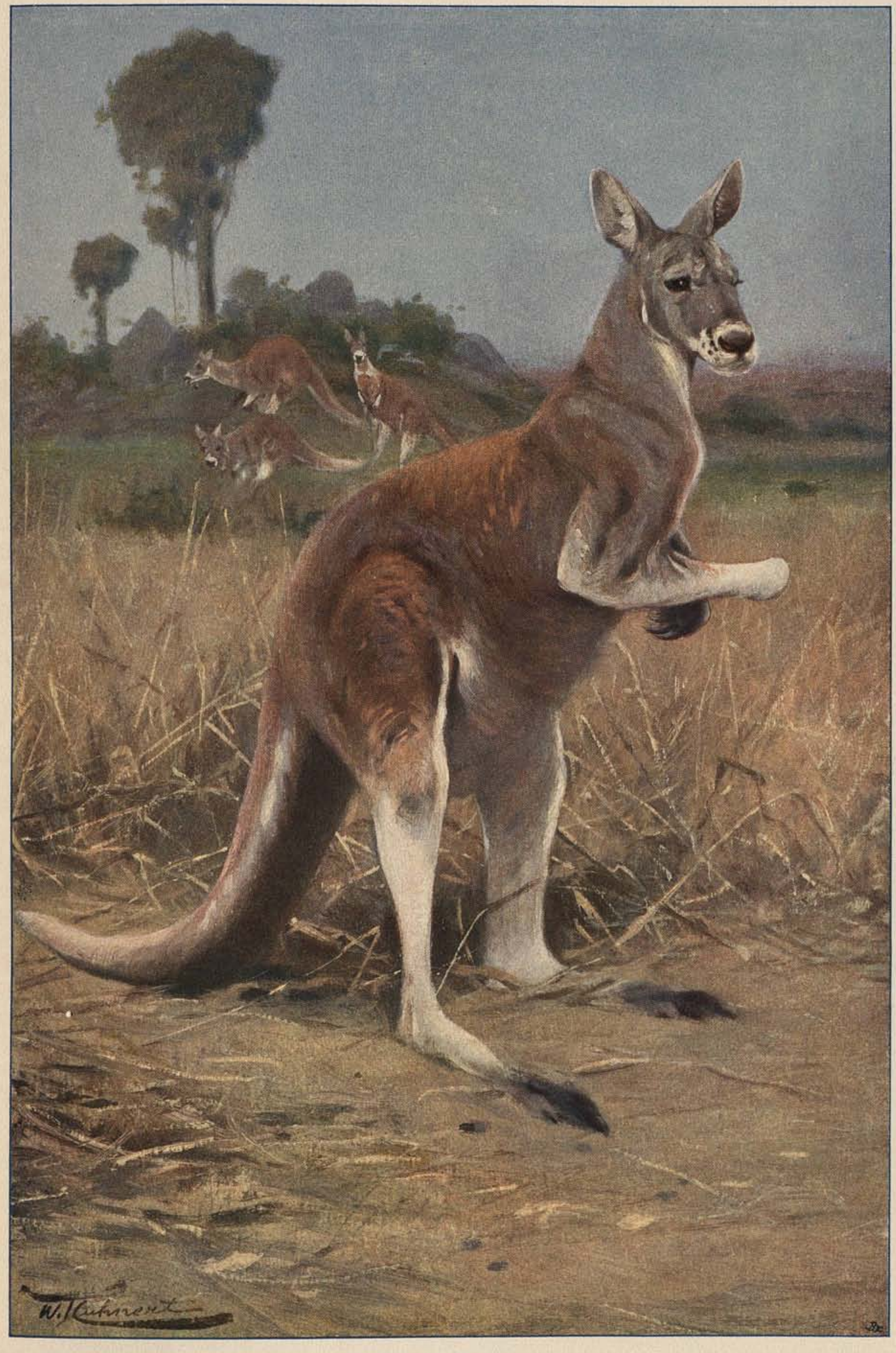
The largest living herbivorous marsupials are to be found among the kangaroos, or *Macropodidæ*, a group of which all the members, despite great specific variation in size, are adapted, by the form of their hind-legs, and other peculiarities of structure, for leaping rather than running. In contrast to the short and feeble five-toed fore-legs, the hind-legs are of great length and strength, and are characterised by the remarkable conformation of the toes, of which there are usually four. Of these, the one corresponding to the fourth of the typical series of five is extremely large, and furnished with a strong claw; the outer, or fifth, toe, although much smaller than the fourth, is also comparatively stout, but the two inner toes (the second and third) are slender and short, and so intimately connected with one another by the skin as to afford no assistance to their owner in leaping. This extraordinary development of one toe in the leaping marsupials, as in a few other swift-footed animals such as the horse and the ostrich, prevents a too prolonged contact with the ground, when in rapid motion, and thus adds to the speed. The tail, by means of which kangaroos help to support themselves while at rest, as a rule is powerfully developed, being long, thick at the root, rapidly tapering, and in some cases adapted both for grasping objects and for supporting the body, thus serving as a third hind-leg. The hind portion of the body is correspondingly strong in the kangaroos; the females of which are provided with a large pouch opening towards the front. The comparatively small head has a tapering muzzle with a cleft upper lip; while the lower jaw is furnished with a single pair of large projecting spatula-like front teeth, which present the peculiarity of working against one another like the blades of a pair of scissors. From this character, kangaroos, and all the remaining members of the order, are classed in a separate section, the Diprotodontia, or those with two lower incisors. They form the most specialised group of the Marsupialia, which appears to have been evolved in the Australasian region, to which it is restricted. Kangaroos, together with their smaller relatives the wallabies, attain their greatest development in Australia and Tasmania, although they are also represented in New Guinea. In Australasia they occupy the position in nature held by cattle, sheep, antelopes, deer, and other ruminants in the rest of the world.

Taking the great grey kangaroo (*Macropus giganteus*) as the typical representative of the whole group, it may be mentioned that when browsing, or standing up to survey the country, this animal raises itself into an erect posture on the tips of its enlarged fourth and fifth hind-claws (that is to say, those corresponding to the fourth and fifth in the typical series of five), at the same time making use of its tail as an additional support. In other circumstances, these kangaroos move on all fours, as in the act of grazing on short grass, when they crouch on the ground. As a rule, however, they support themselves solely on the hind-legs and tail in a most characteristic pose. Owing to the fact that the lower segment of the hind-leg is very long while the upper portion is comparatively short, the pelvis is placed obliquely in relation to the back-bone, so that when the animal is resting on the soles of its hind-feet the lower portions of the legs form two pivots on which the body, supported by the tail, is hung and moves freely. When moving hastily from this position, the animal springs on its hind-legs, using the tail to preserve its balance and holding its fore-legs pressed close to the chest. A kangaroo clears fallen trees or low fences in immense leaps, the powerful tail at the same time striking the ground in measured thumps, the sound of which can be distinctly heard at a considerable distance. In addition to various kinds of grass, more especially the so-called kangaroo-grass, to which they are very partial, kangaroos feed on herbs and the tender shoots of young trees and shrubs, and at night often enter cultivated fields to graze on the crops. When grazing, they remind the spectator of wild sheep or deer. Singularly keen of scent, they also possess highly developed powers of sight and hearing, but, like hares, appear unable to see objects immediately in front of them, and have been known to leap straight towards a gunner. As a rule, they go about in droves or "mobs," as they are locally called, one member of which gives the signal in case of approaching danger. Their numbers are, however, now much less large than formerly, when they could be counted in parties of from 50 to 60, or even 150, head. Separate herds do not mingle, each frequenting its own special feeding-ground. These spots are usually situated on sparsely wooded slopes, and connected with one another by well-trodden paths, but during the hot season kangaroos repair to thickly wooded valleys, whence they return in the rainy season to the more sandy districts. On these feeding-grounds they will remain, if undisturbed, resting for hours at a time. At twilight they start off for their feeding-grounds, which both at night and in the early morning are often crowded with these animals. On their way, and, as a rule, whenever they are on the move, they blindly follow a leader, who when once started cannot be diverted from the direction chosen, and when hard pressed will not hesitate to take to the water. Kangaroos are indeed good swimmers, and have been known to swim against wind and stream over an arm of the sea fully two miles across. On the whole, the kangaroo is a peaceful and harmless creature, but in the pairing-season the old males will fight fiercely among themselves for the possession of their mates, although at other times they live solitary lives. The young are born a short time after the pairing-season, which usually, although by no means always, takes place in January or February; and the young, of which there is never more than one at a birth, remain in the maternal pouch until old enough to run with their elders. Even then, however, if danger threaten, they seek safety by springing into the pouch, in which the female will carry them, until she herself is so hard pressed as to be in danger of life, when she will cast them away to save herself. Towards the latter part of the year the young are big enough to shift for themselves, and then associate with others of the same age in companies often numbering as many as fifty head.

The great grey kangaroo aforesaid, which is common to Australia and Tasmania, is a slender and somewhat gracefully built species, clothed with soft, woolly hair, greyish brown above, and nearly white beneath and on the inside of the legs. It is specially characterised by the hairy centre of the muzzle and the shortness of the crowns of the cheek-teeth. The males stand nearly five feet in height, exclusive of the tail, which measures fully a yard. These kangaroos frequent open grassy valleys and districts abounding with brushwood. The great red kangaroo (*M. rufus*), on the contrary, prefers rocky ridges and open plains, and is confined to South Australia and the eastern and south-eastern parts of the continent. It is distinguished by the brilliant rufous colour of the coat of the males and the bluish grey fawn of that of the females. The face in both sexes is light-coloured, with a whitish blotch between a pair of black whisker-like marks; and in both the tail is grey. This species is the largest of all kangaroos, attaining a total length, inclusive of the tail of 42 inches, of no less than 9 feet. In a third species, the antilopine kangaroo (*M. antilopinus*) of North Australia, which also dwells in rocky country, and resembles the red kangaroo in the form of its muzzle and teeth, the coat is rufous in colour, but short, coarse, and straight, without any under-fur. The face has no markings. This species measures about 8 feet in total length, the body and head being nearly 5 feet and the tail 3.

Another well-known species is the wallaroo (*M. robustus*), which is nearly similar in size, and of the same heavy build as the last, and inhabits Queensland, New South Wales, Victoria, and South Australia, and is characterised by the thick, coarse, and moderately long smoky brown fur.

Wallabies. The wallabies or scrub-kangaroos, although of smaller size, and generally more brightly coloured, are nearly as good jumpers as the typical kangaroos. Among them is the red-necked wallaby (*M. ruficollis*) of



RED KANGAROO.

southern Queensland, New South Wales, and Victoria, represented in Tasmania by the race known as Bennett's wallaby. This species is the largest member of the wallaby group, attaining a length of about six feet, inclusive of the tail. Near akin is the black-tailed wallaby (*M. ualabatus*), of Victoria and New South Wales; while a third is Parry's wallaby (*M. parryi*), a slender, long-tailed species inhabiting the mountainous districts of Queensland and the north of New South Wales. The agile wallaby (*M. agilis*), distinguished from the other species by the uniformly sandy colour of the short hair on the back, and the distinct white stripe on the flanks, is a native of the Northern Territory, Queensland, and New Guinea. In the smaller wallabies the bodily size does not much exceed that of a rabbit; and owing to their relatively shorter hind-legs the members of this group are by no means such good jumpers as their larger relatives. They have a wider geographical range than the typical kangaroos and larger wallabies, being represented by one species in the Aru Islands, and another in New Britain. A third kind is the red-bellied wallaby (*M. billardieri*), of Victoria and Tasmania; a fourth is the short-tailed wallaby (*M. brachyurus*), of western Australia; while the common pademelon wallaby (*M. theditis*) represents the group in Victoria, New South Wales, and Queensland.

Rock-Wallabies.

Yet another well-marked group—this time a genus—is formed by the rock-wallabies of Australia, all of which are of medium size, with no hair around the nose, and a short fourth claw to the hind-foot. They are further distinguished from the typical wallabies by the thinner tail, which is more or less tufted at the tip and less adapted to serve as a support for the body. While the typical wallabies are dwellers in the plains, the rock-wallabies, as their name implies, frequent more rugged districts. Among them, the brush-tailed wallaby (*Petrogale penicillata*) associates in parties on the rocky portions of the eastern coast. In this species the coat consists of long, coarse brown hair, with a tendency to rufous, but passing into pale grey on the chin and chest. The length averages about 52 inches, inclusive of the tail, which measures nearly 23 inches. A second kind, the yellow-footed rock-wallaby (*P. xanthopus*), of South Australia, is the largest of the group, and is distinguished by its bright colouring and markings, particularly on the tail, which is brown and pale yellow on the upper side, in alternating rings. The under surface is yellowish or brownish white; and above the eyes is an orange spot, while below them a whitish stripe runs from the muzzle to behind the ears. The long ears are yellow, with white margins on the inner side, except at the tips, and between them commences a distinct black stripe, which extends along the grey back to the middle of the body, while there is also a white stripe from the shoulder to the hip on each flank. Among species smaller than the brush-tailed wallaby, the short-eared rock-wallaby (*P. brachyotis*) takes its name from the very short fawn-coloured ears, which are edged and tipped with white.

Nail-tailed Wallabies.

The nail-tailed wallabies, which are also unknown in Tasmania, and appear to be exclusively inhabitants of dry and rocky districts, have hairy muzzles, and are further distinguished by the great length and slenderness of the fourth hind-toe, but more especially by the presence at the tip of the tapering tail of a kind of horny spur, of which the function is still unknown. This spur is particularly large in the typical nail-tailed wallaby (*Onychogale*, *unguifera*). a species with the tail measuring about 26 inches, and the head and body almost as long. This wallaby is a rather rare inhabitant of the north-western and northern central districts. The bridled wallaby and the crescent wallaby (*O. frenata* and *O. lunata*) are characterised by their rather shorter tails; the latter species being about the size of a rabbit and living in the west and south, while the former is confined to the eastern side of Australia.

Hare-Wallabies. The members of a small group of wallabies restricted to the Australian continent and the islands off the coast are readily distinguished by the inferior size of their upper incisor teeth, and the great length of the fourth claw of the hind-foot, which is not concealed in the hair, as well as by the somewhat short, evenly-haired tail, devoid of a horny spur. They have received the name of hare-wallabies from their superficial resemblance to hares. The typical *Lagorchestes leporoides*, which recalls a hare both in colouring and mode of life, inhabits the treeless districts of the interior of South Australia and New South Wales, especially the flats bordering the Murray River, where it is comparatively common. Very similar in habits is the rufous hare-wallaby (*L. hirsutus*), of western Australia, characterised by the ruddy colour of the hair of the hind parts of the body. A third species, the spectacled hare-wallaby (*L. conspicillatus*), inhabits the islands off the north-west coast, and is replaced on the mainland by the more brightly coloured *L. leichardti*.

Tree-Kangaroos. The members of the kangaroo family are by no means restricted to a life on the plains or in the hills, for certain species inhabiting the primeval forests of northern Queensland and New Guinea have adopted a completely arboreal existence. In these tree-kangaroos, constituting the genus *Dendrolagus*, the relative proportions of the fore and hind limbs are nearly normal; the hind-legs being only a little longer than the front pair, while the inner toes of both pairs are provided with claws nearly equal in length to the one on the outer toe, that of the hind-foot being distinctly curved. By means of these claws, added in some degree by the tail, which, however, has no prehensile power, tree-kangaroos cling so tenaciously to the boughs of forest trees that it is frequently difficult to dislodge their bodies after death. Nevertheless, although most of their life is spent amid the boughs, their movements when climbing are decidedly awkward and slow. Perhaps this may be an indication that these kangaroos were not, so to speak, born to this mode of life; for although it would not be unreasonable to suppose that they represent the original type from which the leaping kangaroos of the plains were evolved, yet it is perfectly evident that this is not really the case, and that tree-kangaroos represent a kind of retrograde modification from the leaping type.

A considerable number of species of this group are now known, the majority of them being Papuan. Of the Australian species, the Queensland tree-kangaroo (*D. lumholtzi*) inhabits the densest and most inaccessible forests of the province from which it takes its name, where it may best be observed on moonlight nights. For it is a shy creature, believed to chiefly frequent only one particular kind of tree, on which it sleeps away the daylight hours in company with one or two of its own kindred, repairing in bad weather to trees of lower growth. Although now well-nigh exterminated by the natives, the numerous marks of its claws on the tree-trunks of the less densely wooded districts indicate its former abundance.

Banded Wallaby. Another interesting member of the same family is the banded wallaby (*Lagostrophus fasciatus*), specially characterised by the long bristly hair covering the claws of the hind-feet, as well as by the transverse dark bands across the hind-quarters. This wallaby leads a different kind of life on the continent to that which it lives in the islands, for whereas on the mainland it frequents open ground in the neighbourhood of swamps, and even treeless plains, on the islands it forms long tunnels amid thick brushwood from which it can be driven out only with difficulty.

Kangaroo-Rats. Kangaroo-rats, as they are called by the colonists, include several small-sized members of the family differing so remarkably from all their kindred as to form a separate subfamily, the members of which are confined to Australia and Tasmania, and are arranged by naturalists in four generic groups. In size they may be compared to rabbits, but they have short, rounded ears, and long, thickly haired tails. The two small and curved middle upper incisor teeth are adapted for gnawing; the hind cheek-teeth are four-cusped, but the first of the series in each jaw is very long and narrow, with a sharp cutting-edge, and the two lateral surfaces vertically grooved. The knife-like form of this tooth is specially adapted to the mode of feeding and the nature of the food of these kangaroos, which consists of roots, bulbs, grass, and leaves. The fore-feet, which are largely used for digging out those parts of the food-plants deeply buried in the soil, are narrow, with the three middle toes much longer than the rest, and provided with long, narrow, slightly curved claws. All the kangaroo-rats have comparatively short hind-legs, and are therefore not particularly good leapers. Nevertheless, they usually support themselves on the hind-legs alone, and when running move their fore-legs with a kind of galloping action. They never kick with their hind-legs after the fashion of kangaroos and wallabies, and in their mode of life are more like rabbits and hares than any other marsupials. A familiar species is the common kangaroo-rat (*Potoroüs*, or *Hypsiprymnus*, *tridactylus*), distinguished by its rat-like muzzle, and confined to New South Wales, Victoria, South Australia, and Tasmania. This is the largest member of the group, usually attaining a length of about 16 inches, inclusive of the tail, which measures 9 inches. Although the long, coarse, straight hair varies somewhat in colour, it is usually a mottled greyish brown. A second species, Gilbert's kangaroo-rat (*P. gilberti*), is smaller and a native of Western Australia; that district being also the home of the broad-faced kangaroo-rat (*P. platyops*), which does not measure more than 22 inches, inclusive of its 8-inch tail.

The prehensile-tailed kangaroo-rats form another generic group, distinguished by the comparatively short, broad head, very small, rounded ears, naked muzzle, and long feet and tail. The tail is thickly haired and crested, and also to a certain extent prehensile, being coiled up at the tip and employed in carrying bundles of grass for lining and covering the burrow. The entrances to these holes are always carefully concealed with herbage piled up by the owners, which leave their domiciles only in the evenings in search of food. The most widely distributed species is the brush-tailed kangaroo-rat (*Bettongia penicillata*), readily distinguishable by the abundant growth of hair on the upper side of the tip of the tail, and ranging almost all over Australia, but replaced in Tasmania by the larger *B. cuniculus*, which has scarcely any crest to the tail. South and Western Australia form the home of another member of the group, known as Lesueur's kangaroo-rat (*B. lesueuri*), in which the tail is but slightly crested and nearly always white at the tip. Another group is represented by the plains kangaroo-rat of South Australia (*Caloprymnus campestris*), which differs from the prehensile-tailed group by the absence of a crest of hair to the tail, and on this account, in association with peculiarities in the skull and teeth, is referred to a genus by itself. In length the head and body measure about 18 inches and the tail 14 inches. The last member of the subfamily is the rufous kangaroo-rat (*Æpyprymnus rufescens*), of New South Wales, characterised by the hairy nose and crestless tail, as well as by its bright rusty red fur, more or less streaked with white above and dirty white beneath. The ears are black, and there is a whitish hip-stripe. This animal is about 21 inches long, exclusive of the tail, which gives another 15 inches. These kangaroo-rats either build nests like those of the prehensile-tailed species, under fallen trees or low bushes, or repose during the day after the manner of a hare, in an open "form" amid grass and herbage. If driven from this covert, they run very rapidly for a short distance but sooner or later take refuge in some hollow log or hole in the ground, where they fall an easy prey to the Australian natives, by whom the flesh is much esteemed. It may be added that naturalists have attempted to replace the name "kangaroo-rat" by "rat-kangaroo."

Musk-Kangaroo. Perhaps the most interesting of all the smaller *Macropodidæ* is the musk-kangaroo (*Hypsiprymnodon moschatus*), since it forms a kind of connecting link between the typical kangaroos and the arboreal Australian opossums. On account of the similarity of the structure of its lower jaw to that of the kangaroos, this species has been classed with that group, but the conformation of the hind-foot much more resembles that of the Australian opossums. As in the latter group, the hind-foot of the musk-kangaroo is five-toed, having a well-developed, although clawless, first-toe, placed high up near the heel-joint and freely opposable to the other toes; while the second and third toes are but feebly developed and united by skin, the fourth being by far the largest and longest. The fore-legs, which are not much shorter than the hind pair, resemble those of other kangaroos. This species, which derives its name of musk-kangaroo from the strong scent it emits, is about the size and build of a rat, with rather large, naked ears, and a tapering naked and scaly tail. The body is clothed with thick, curly, velvet-like fur of a mottled reddish orange-grey, brightest on the back and palest on the under-parts. In spite of its bright colouring and partiality for a diurnal life, this little animal, which is chiefly confined to northern Queensland, where it is by no means rare, is not often seen and caught. Frequenting the thickest and dampest spots in woods bordering the rivers and coast mountains, it is generally seen singly or in pairs, except during the rainy season, from February till May, when the females are accompanied by their two young.

Its movements are very similar to those of a small kangaroo, and it digs for bulbs and roots in the ground, although it procures most of its food, which includes insects and worms as well as berries, by turning over dead leaves and other rubbish with its front paws. While eating, it holds its food in its front paws in the same manner as a squirrel.

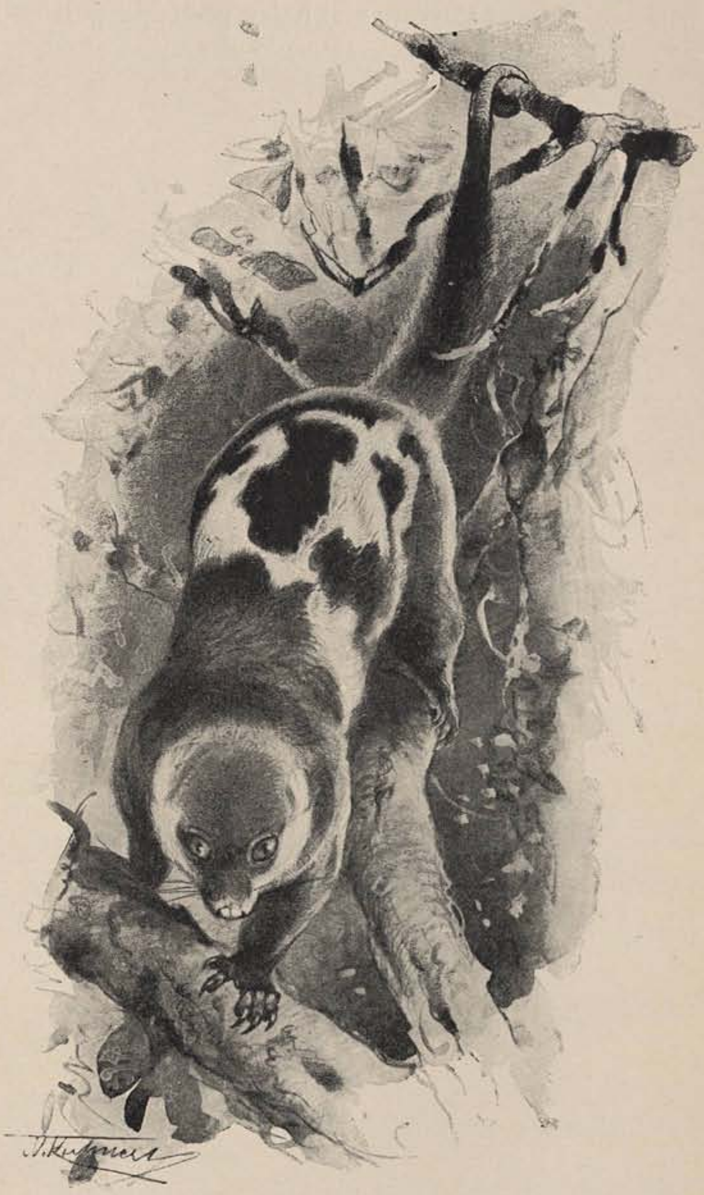
Long-snouted Phalanger. The earlier colonists of Australia and Tasmania were singularly unfortunate in the names they bestowed on several of the animals with which they came in contact in their new home. We have already mentioned the inappropriateness of the name "native cats," as applied to the typical members of the *Dasyuridæ*; and, if they had to use the name opossum at all, it would have been far better if it had been used in connection with those animals. As ill-luck would have it, the colonists, however, applied this designation to a group of arboreal marsupials closely connected with the kangaroo tribe by means of the musk-kangaroo. Naturalists have attempted to get over the difficulty by proposing to apply the term "phalanger" to the miscalled Australian opossums, but since in popular language they will continue to be known by that name, naturalists must bow to the inevitable. The designation "phalanger" is, however, a convenient one to apply to the more aberrant Australian members of the family *Phalangeridæ*, the typical representatives of which are the cuscuses of North Australia, New Guinea, and Celebes.

THE LONG-SNOUTED PHALANGER.

Although the musk-kangaroo renders it a somewhat difficult matter to draw a concise distinction between the *Macropodæ* and the *Phalangeridæ*, all the members of the latter group have clawless first toes opposable to the other digits, and the second and third hind-toes slender and united by skin; but the fourth hind-toe, which in the kangaroos is longer and stronger than the rest, in the phalangers is not much larger than the fifth, and the evenly toed fore-legs are not disproportionately smaller than the hind pair. All the members of the family have comparatively long tails, which in many species are prehensile. These marsupials live in trees, where they feed largely on vegetable substances, although they are all more or less omnivorous. In size they are medium or small, and comprise a large number of species, the collective range of which includes all the wooded districts of Australia. Among them are the only marsupials furnished with expansions of skin, by means of which they are enabled to take long, flying leaps.

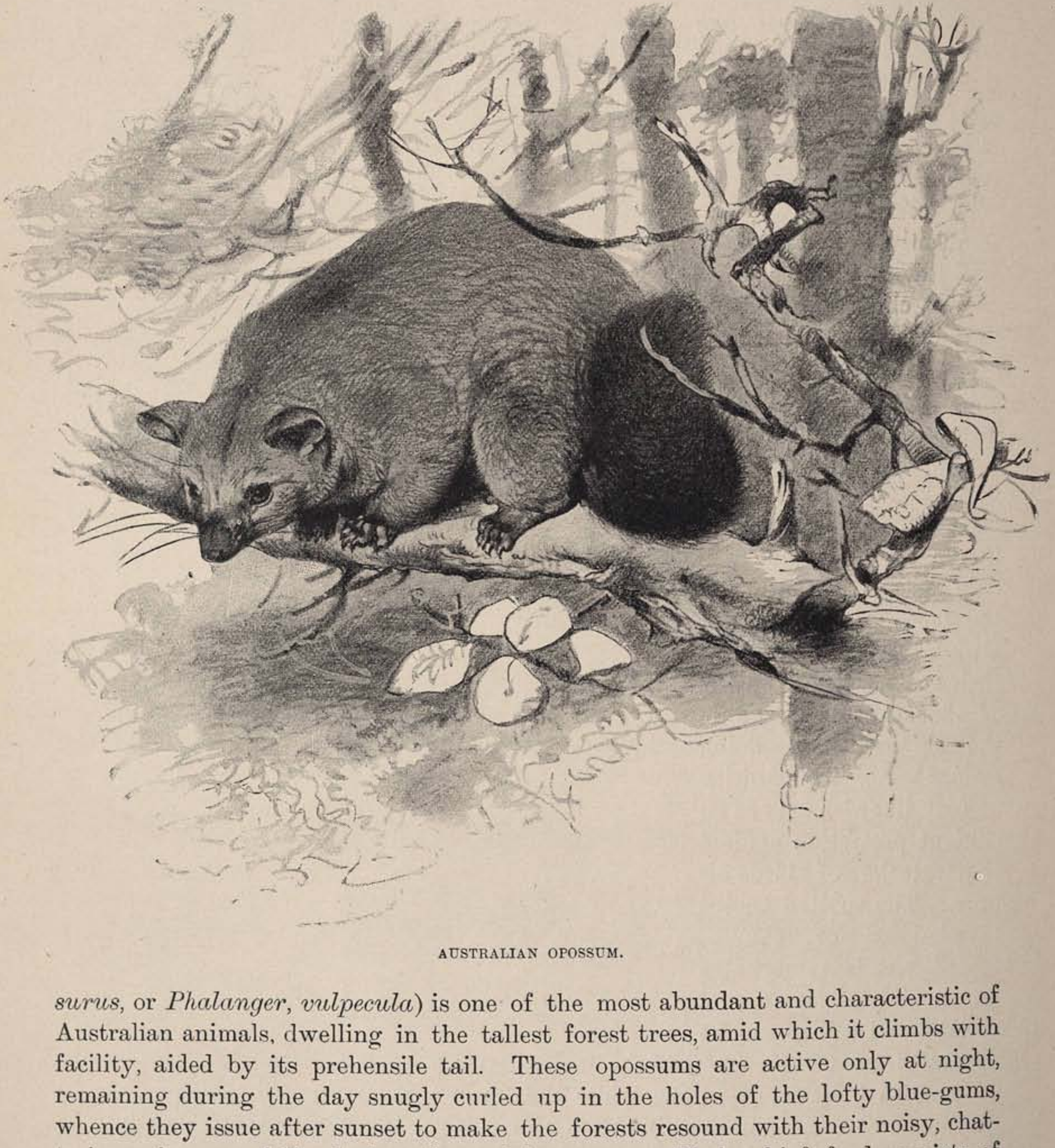
Seeing that nearly all the flowering plants of Australia yield honey, it is not surprising that the fauna of the country should include a honey-sucking marsupial. Somewhat curiously, however, the long-snouted phalanger (*Tarsipes rostratus*), which possesses this habit, is restricted to Western Australia, where in many parts it is rare, although in others comparatively common. This tiny little creature frequents low scrub, in which it builds a nest, in the higher branches. Only at night does it venture out in search of honey, which it sucks from flowers by means of its slender, pointed tongue, which can be protruded far beyond the elongated muzzle. This great length of the pointed muzzle, the small size of the mouth, and the nature of the food, suggest a slight development of the teeth; and as a matter of fact this is the case, although the two front teeth in the lower jaw are comparatively large. Certain individual variations in the number of the teeth are further suggestive of the slight use made of those organs; such numerical variations generally occurring only in animals in which the teeth are little used. The claws are likewise rudimentary, being small and embedded in the flesh of the toes, a somewhat notable feature in a climbing animal. Owing, however, to the nature of its food, this phalanger has only to climb among the thin blossom-bearing twigs, so that its feet serve more for grasping these than for clinging to the bark of the thicker boughs and trunks. For the same purpose some use is also made of the prehensile tail, which is one quarter longer than the head and body, cylindrical in shape, tapering sharply at the tip, and covered with short hair for the greater part of its length. In general appearance this elegant species much resembles a shrew-mouse, but its true nature is at once shown by the presence in the female of a well-developed pouch. The fur is short, thick, and somewhat coarse, the ears are small, rounded, and covered with short hair, while the eyes look like small black pearls. The colour varies somewhat individually, but in general is of a more or less reddish tinge above and yellowish grey below; the head being brown on the top and yellowish red at the sides, and a black line running from the forehead along the back to the root of the tail between two grey bands, each bordered by a reddish brown stripe.

Cuscuses. The sleepy-looking animals known as cuscuses form another group of the phalanger tribe, most of the members of which are about the size of cats; while all possess long prehensile tails, with the terminal portion naked. The soles of the feet are likewise devoid of hair, the front pair being so formed that their first and second toes are to a certain extent opposable to the rest. The medium-sized ears are hairy externally, and in some cases also internally, the eyes are large, and the fur is thick and woolly. Cuscuses are sleepy and stupid during the day, and only become lively at night, when they issue forth to feed, and even then they are generally slow and deliberate in their movements. Dwellers in the forests amid lofty trees, they spring from bough to bough like squirrels, or swing, after the manner of South American spider-monkeys, by their tails from one bough till they are enabled to reach the next with their fore-feet. They feed on leaves and fruits as well as on birds and other small animals, and are really the most carnivorous of their tribe. Although nowhere very common, they are frequently caught for the sake of their flesh; the natives climbing the trees in which they live and seizing them without difficulty on account of the slowness of their movements. They are, however, by no means easy to kill; and even severe wounds in the brain or spine will only cause their death after the lapse of some hours. Owing to the thickness of their coats, a heavy charge of shot merely lodges in the skin without doing serious harm. This density of coat likewise acts as an efficient protection against the attacks of birds-of-prey. The spotted cuscus (*Phalanger*, or *Cuscus*, *maculatus*) is remarkable for exhibiting a sexual variation in colour almost unparalleled among mammals, the males having the fur dirty white in ground-colour with blotches of rufous, while the females, which exceed their partners in size, are in most cases uniformly grey or blackish. These cuscuses are natives of Cape York Peninsula, New Guinea, and some of the neighbouring islands, the other members of the group inhabiting the islands of the Austro-Malay Archipelago as far west as Celebes.



SPOTTED CUSCUS.

Australian Opossums. Nearly related to cuscuses are the climbing marsupials known in Australia as opossums, but, as already mentioned, termed phalangers by naturalists, who have transferred the scientific name *Phalanger* to the animals first named. These Australian opossums are characterised by the hairy outer surfaces of the ears and hairy posterior portion of the soles of the hind-feet, as well as by the presence of a gland on the chest. The common species (*Trichosurus*, or *Phalanger*, *vulpecula*) is one of the most abundant and characteristic of Australian animals, dwelling in the tallest forest trees, amid which it climbs with facility, aided by its prehensile tail. These opossums are active only at night, remaining during the day snugly curled up in the holes of the lofty blue-gums, whence they issue after sunset to make the forests resound with their noisy, chattering cries, especially during the pairing-season. Their chief food consists of leaves, to which is added occasionally the flesh of a bird. The female carries her one or two young in her pouch while they are small, but later on bears them



AUSTRALIAN OPOSSUM.

clinging to her back. The species derives its name from its superficial resemblance to a small fox. In colour its thick fur is grey above and yellowish white underneath, with the bases of the ears white and the tail black. It inhabits the forests of the mainland, with the exception of Cape York Peninsula; its Tasmanian representative (*T. v. fuliginosus*) is larger and more stoutly built, with longer hair, of a browner or redder tint, and has little or no white on the ears. In both races the ears are long and narrow. The short-eared phalanger (*T. caninus*), which has smaller and more rounded ears, is a native of southern Queensland and New South Wales, where it frequents the scrub in preference to trees. It is a nocturnal animal, closely resembling the common species in habits.

Ring-tailed Phalangers. Nearly allied are the ring-tailed phalangers, or opossums, also known as crescent-toothed phalangers, from the crescent-shaped cusps on the crowns of the cheek-teeth. The members of this group, which inhabit Australia, Tasmania, and New Guinea, differ from the true phalangers not only in outward appearance, but in the absence of a gland on the chest, and in the first toe of the fore-paws being opposable to the others. With the exception of the yellow phalanger (*Pseudochirus archeri*), the Australian and Tasmanian species are characterised by the medium size of the ears, in which the length exceeds the breadth, whereas in the yellow phalanger and the Papuan species the ears are short and broad. The Papuan members of the group also lack a white tip to the tail, which is present in all the Australian and Tasmanian species except *P. lemuroides*.

Flying-Phalanger. As an example of the flying members of the group, mention may be made of the flying-phalanger (*Petauroides volans*) of Queensland and Victoria, which is furnished with a flying-membrane similar to that of the flying-squirrels. Practically this animal is a phalanger with a membrane for flight, the dentition and the structure of the skull as well as the tail being of the same type as in the ring-tailed phalanger. Outwardly the flying-phalanger is distinguished by its long silky hair—dark brown above and white below—its thickly haired ears, and especially by the flying-membrane, which extends from the fore-foot to the ankle, but becomes much narrowed on the fore-arm and lower part of the leg. Locally it is known as the taguan flying-squirrel, and is the largest of the flying-phalangers.

Striped Phalanger. The handsome striped phalanger (*Dactylopsila trivirgata*), so-called on account of the broad, black and white stripes running down the back, has the tail of the same type as the last two groups, but is provided with an unusually long fourth front toe, supposed to be used for extracting insects and their larvæ from beneath the bark of trees.

Squirrel-Phalanger. A small species peculiar to Victoria, known as the squirrel-phalanger (*Gymnobelideus leadbeateri*), is nearly related to the next group of flying-phalangers, almost the only difference being the absence of a flying-membrane.

Squirrel Flying-Phalangers. The squirrel flying-phalangers are small or medium-sized marsupials, with a broad membrane, extending from the extremity of the fore-foot to the ankle, by means of which they are carried for long distances through the air. Among these, the yellow-bellied flying-phalanger (*Petaurus* *australis*), inhabiting the mountain-districts of New South Wales and Victoria, is stated to be able to fly, not only from the summit of one gum-tree to another, but also to shoot long distances upwards into the air, extending its membrane with the impetus of its spring from the tree, and thus sweeping forwards with the greatest certainty, and alighting on the ground or on a tree-trunk some way off, when it avoids too violent a shock by ascending once more into the air as it terminates its flight. Unless compelled to do so, these phalangers avoid, however, taking long flights to the ground, as they are thoroughly arboreal, and move somewhat awkwardly except among the branches. They pass the day in holes in trees, and are very lively at night, when they run along the bough in search of insects and the honey in the flowers at the tops of the gum-trees. A well-known species is the common squirrel flying-phalanger (*P. sciureus*), the sugar-squirrel of the colonists, which has a body-length of 20 inches, with a somewhat longer tail. Among its distinctive features may be mentioned the medium-sized ears, very bushy tail, and very soft fur, mostly ashy grey in colour with white and black markings; the cheeks are white, the backs of the ears, the chin, and the under surface of the flying-membrane being white, while there is a black crescent under each eye and black under the ears, and on the tip of the tail.

Dormouse-Phalangers. Certain small phalangers, characterised by their resemblance to dormice, are distributed over Tasmania, Western Australia, and New Guinea. They are also nocturnal animals, passing the day under the loose bark of trees, or in other places of refuge, and feeding on honey, grass, and probably insects. They may be recognised by the cylindrical mouse-like tail, covered with hair at the root, scaly in the middle, and naked at the prehensile tip. The smallest is the western dormouse-phalanger (*Dromicia concinna*), measuring in some instances only about 3 inches to the root of the tail, which is a little longer than the head and body.

Pigmy Flying-Phalanger. Very small, too, is the pigmy flying-phalanger (*Acrobates pygmæus*), perhaps the smallest of all marsupials, being barely 6 inches in total length, of which one moiety is formed by the tail. In spite of its well-developed pouch, this tiny phalanger is a most delicately formed creature, whose newborn young are indescribably minute. The long, soft, silky fur is brownish grey above and white beneath, with the inner side of the limbs and the margins of the membrane also white. From its nearest relatives, the dormice phalangers, it differs by the expanded tips of the toes, and the possession of a flying-membrane, which is, however, very narrow, extending only from the elbow to the knee, and disappearing on the flanks, although evidently sufficient for flight, as the agility of this little animal is wonderful. The pigmy phalanger, which feeds on honey and insects, is a native of Queensland, New South Wales, and Victoria, and is especially common in the vicinity of Port Jackson and Sydney Harbour.

Koala. With the koala, or so-called native bear (*Phascolarctus cinereus*), which is restricted to eastern Australia, from Queensland to Victoria, and is a lazy, slow-moving creature, so well adapted to an arboreal life, that it can with difficulty move on the ground, and when pursued takes refuge up a tree as quickly as possible, we come to a totally different type of marsupial, representing by itself a distinct family, the *Phascolarctidæ*. Although koalas are occasionally seen on the ground, where they dig for roots, their food is chiefly formed by the leaves of the blue-gum, and they accordingly spend most of their time in those trees, where they creep along the boughs in the shades of evening and at night, the females carrying their young on their backs. As a rule, these animals pass the day in repose in the tree-tops, but occasionally they may be seen in daylight climbing in pairs among the branches. When disturbed, they utter loud, hoarse grunts, sometimes described as shrill yells, recalling those of sloths. The feet, with their long claws, are well adapted for clinging, the thumb and its claw being so formed that the hands can grasp by means of this and the other claws. In appearance koalas are clumsy, and distinguished from phalangers by the absence of a tail; while they are also noticeable for their large, broad ears, thickly covered with brownish grey hair. The general colour is yellowish white on the hind-quarters, and white beneath, and the coat is extremely thick and soft. In length a full-grown koala will measure about 20 inches.

PIGMY FLYING-PHALANGER.

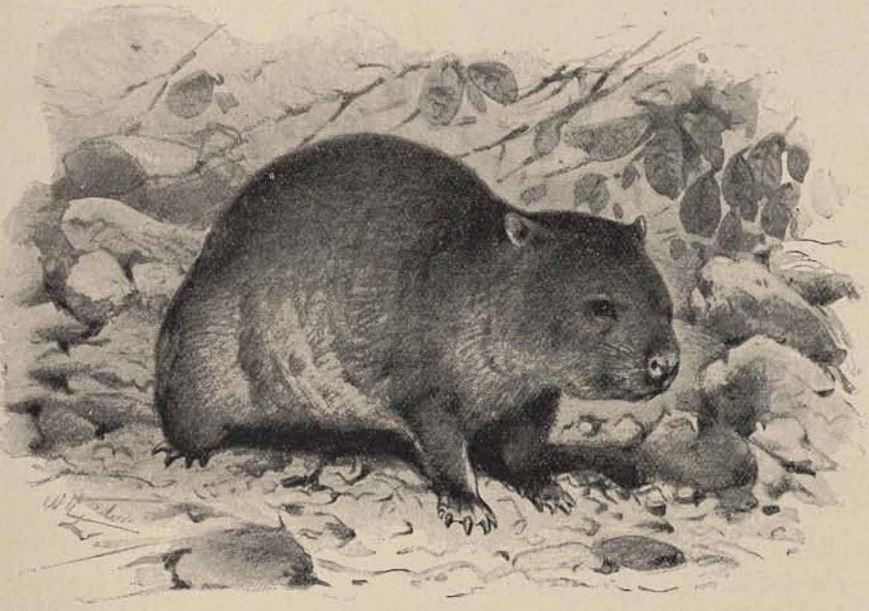
Wombats.

Although, like the koala, wombats present some resemblance to small bears, they may more aptly be compared to large rodents, which they resemble in habits, as well as to some extent in dentition. Wombats live in burrows of their own making, or in clefts and crevices among rocks. Purely nocturnal in habits, they feed on roots, grass, and other vegetable substances. When disturbed, they utter a sort of hiss, and on rare occasions will bite when attacked, although in general they may be easily captured, and when once in confinement offer no resistance. The front, or incisor, teeth are powerful and chisel-shaped, with no enamel on the back, and without roots, so that they grow throughout life. Their hind-feet present a considerable resemblance to those of the Australian opossums, the second and third toes being slender and partially united, but the first is without a claw and incapable of being opposed to the rest. On the other hand, all the five toes of the front feet are provided with powerful claws adapted for burrowing, and both pairs of limbs are short and thick. The blunt and flattened head is surmounted by short or medium-sized ears, the eyes are relatively small, and the tail is reduced to a mere stump.

Wombats constitute a family by themselves, the *Phascolomyidæ*, which is represented at the present day by four species, restricted to Australia, Tasmania, and the small islands in Bass Straits. Of these, the typical *Phascolomys mitchelli* is a native of New South Wales, Victoria, and South Australia. Either grizzly yellow or wholly black in colour, this wombat is the largest of the group, measuring about 44 inches in length. The smallest is the Bass Strait wombat (*P. ursinus*), long confounded with the Tasmanian species; it is characterised by its smaller and rather rounded ears, the naked tip of the muzzle, and the coarse, rough hair. In colour the fur is uniform dark grizzled brown. The Tasmanian *P. tasmaniensis* is a closely allied species. The fourth species, commonly known

THE KOALA.

as the hairy-nosed wombat (*P. latifrons*), is intermediate in size between the first and second. It has somewhat longer and more pointed ears, a hairy muzzle, and a long and silky coat. This wombat was long supposed to be restricted to South Australia, but in the Melbourne Museum are preserved four specimens of this species, obtained from a lonely part of New South Wales in or near Denison county about the year 1884. Whether the species still survives there is unknown, but the donor of the specimens stated that it never occurred in any other part of the colony. These New South Wales hairy-nosed wombats are stated to differ from their relatives of South Australia in the characters of the nose, while the skull appears to be shorter and rounder. If these differences are well established, the New South Wales form apparently indicates a distinct species.

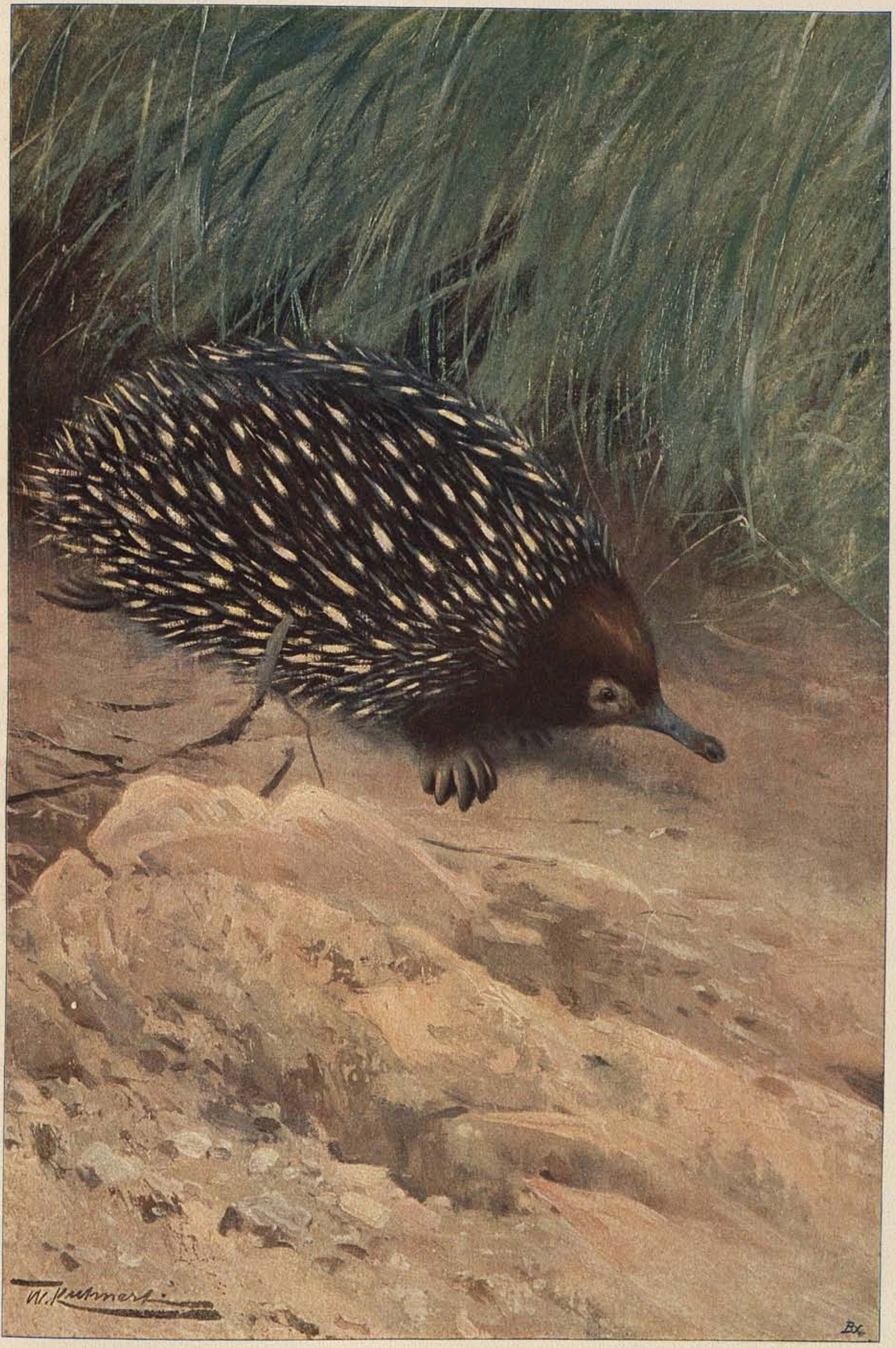


TASMANIAN WOMBAT.

Spiny Anteaters. By far the most peculiar members of the Australian fauna are the spiny anteaters, or echidnas, and the platypus, or duckbill, since these alone represent a group of mammals—the Monotremata—which forms a subclass, and is at the present day at any rate unknown in any other part of the world. When these strange mammals were first made known to European naturalists in the eighteenth and nineteenth centuries it was believed that they resembled birds in laying eggs in place of producing living young. This belief suffered, however, a severe shock by the discovery that they were provided with milk-glands, since the possibility of the existence of egg-laying mammals appeared incredible. The truth of the old belief was, however, fully demonstrated by the discovery in the year 1884 of an egg of the spiny anteater. As a matter of fact, the structure of both the spiny anteater and the platypus differs in so many important respects from that of other mammals, and accords in so many characters with that of reptiles and birds, that it is scarcely a matter for surprise that these animals should resemble the latter in the mode of reproduction. In this connection it may be well to notice that the duck-like, horny beak of the platypus is in no wise indicative of affinity with birds, but is merely a special adaptation to a peculiar mode of life; the same being true with regard to the slender, tooothless beak of the spiny anteaters, which in some degree recalls the equally toothless jaws of their South American namesakes.

The eggs of both the platypus and the spiny anteaters, in comparison with the fœtal eggs of placental mammals, are remarkably large: they have leathery or parchment-like shells, resembling those of reptiles, and are hatched like those of birds. The temperature of the blood in both the spiny anteaters and the platypus is distinctly lower than in other mammals and birds, and subject to great fluctuations—circumstances which point to a near relationship between the egg-laying mammals and the lower vertebrates. It was at one time supposed that the nearest relatives of these strange creatures are the pouched mammals, since both groups possess the so-called "marsupial bones," and are without the fully-developed placenta of the higher mammals; but doubt has been thrown on the nearness of the relationship, and the absence of teats, coupled with the totally different structure of the milk-glands, certainly indicates the much lower grade of the egg-laying as compared with the pouched mammals. In the former group the milk-glands having no nipples, that is to say, no continuation of the skin serving as outlets for the milk which can be grasped by the mouth of the suckling, the young have to suck up the milk as it oozes to the surface from the glands themselves through sieve-like pores in the skin. These animals are therefore only mammals in the sense that they yield milk, although they are not suckling mammals in the proper sense of that term.

Of the two groups of egg-laying mammals, the spiny anteaters, forming the family *Echidnidæ*, or *Tachyglossidæ*, are characterised by the rounded head terminating in a long, thin, beak-like muzzle covered with hairless skin and having at its tip the minute nostrils and small mouth. There are no external ears, but the eyes are fairly large, although the head is very small in comparison with the stout body. The short and stumpy tail is clothed with hairless skin; and the short and sturdy legs are furnished with remarkably powerful claws, those of the hind-feet being turned outwards and backwards when walking. The feet and under part of the body of the spiny anteaters are the only portions covered with hair, the back being protected by rather short thick spines. The palate and tongue are covered with small spines, and the surface of the brain is somewhat complexly convoluted. In the common spiny anteater (*Echidna*, or *Tachyglossus, aculeata*) the spines are very like those of a hedgehog, but stouter and longer. Like hedgehogs, these animals can roll themselves up into the shape of a ball by means of powerful skin muscles. In habits they are harmless creatures, whose only means of defence are their spines. It has indeed been supposed that a peculiar spine on the hind-leg of the male is used as a weapon, but it is probably employed for another purpose. In spite of their enormously powerful burrowing claws the legs are never used for offence; the claws being employed solely for burying their owner in the ground when threatened by danger, or for burrowing in search of insects and their larvæ and digging out and plundering ant-hills. The spiny anteaters seize their living prey in the same manner as other animals whose diet is similar, such as



SPINY ANT-EATER.

woodpeckers, South American-anteaters, and the Old World pangolins and ant-bear. In common with the latter, spiny anteaters have long, thin, protrusile, sticky tongues, to which the insects adhere, and are thus drawn into the mouth of their devourers. The small, slender, and much elongated toothless jaws are encased in a horny covering which forms a sort of tube allowing the passage of the worm-shaped tongue; the opening being closed by means of a horny tip on the lower jaw.

Like all the lower types of mammals, spiny anteaters lead nocturnal lives, and are by no means intelligent animals, although possessing resources and contrivances of which it is difficult to believe them capable. On one occasion, for instance, one of these anteaters which had been confined in a cask effected its escape apparently by climbing up the concave sides. It appears, however, to have missed the company of its mate, which was also in the cask, for a few days later the escaped animal was again discovered in the cask. Another specimen apparently found the small inverted box in which it was kept an uncomfortable residence, as it endeavoured day and night to escape, and repeatedly stretched out its tongue underneath the edges by way of exploration. Finally, one night it succeeded in raising the box and escaping, and for some time was searched for in vain, until finally discovered in another box, about a foot high, and half full of lumps of gold-bearing quartz, wrapped in paper. In these hard quarters it had scratched itself a bed and was sleeping peacefully. At twilight spiny anteaters begin their nightly rambles, seeking on the ground for ants' nests, and in soft, rotten tree-stems for worms and insect-larvæ. At dawn they retire to rest in holes excavated for refuge from the heat of the midday sun; and in such spots they are difficult to discover, as the dark brown coat of spines mottled with lighter tints closely resembles the colour of the parched Australian soil, into which these creatures burrow till they are partially covered. These anteaters display a wonderful capacity for resisting hunger, filling themselves, it is said, with sand if reduced to great want, and living on their own fat. They are thus enabled to pass through the hottest and driest period of the Australian summer in a sort of torpid condition. When the rainy season sets in, in April or May, causing a luxuriant growth of grass to spring up with surprising rapidity, the males, which up to this time have lived alone, proceed to search for mates. About the beginning of August, on nearing the period when the eggs are deposited, the females develop a pouch on the under surface of the body where the skin is baggy, into which the two eggs are transferred as they are laid. As the heat of this breeding-pouch is considerably higher than the general body-temperature, the eggs are hatched in a short time. From their shells emerge small, helpless, naked young, whose only occupation for a long while seems to be sucking up the milk which percolates through the pores of their parent's breast. The breeding-pouch has two side-folds, in each of which lie the sieve-like apertures of the milk-glands; it also contains a few short stiff bristles, which stick together by the action of the milk and thus form a sort of brush. This brush is grasped by the young, which are thereby enabled to obtain nutriment more easily than would otherwise be the case. In this manner the young grow apace, each of them soon forming a ball as large as a fist, the bulk of which gradually enlarges the pouch in which they live. When, however, the spines begin to grow sharp, the mother turns out her offspring to shift for themselves, and once more resumes her rambles in search of food, when the pouch almost disappears, to develop again in the following year.

Many of the young spiny anteaters after leaving the maternal pouch probably fall victims to mammals like the thylacyne, which prey upon them, but their worst enemy is man. Formerly it was only the Australian native who caught them, and, in the same way as gipsies do with hedgehogs, rolled them in clay and roasted them in the fire, but to the native is now added the naturalist and collector who account for a considerable number. The foregoing account may be supplemented by the following observations made by a well-known naturalist, Dr. R. Broom, in the Taralga district of New South Wales in connection with the typical *E. aculeata*:—

"Although the animal has a wide range in the Australian continent, it is probably nowhere very common, its scarcity being due apparently more to the numbers killed by the blacks for food than to natural enemies. Now, however, that the aboriginal race is dying out, it is likely that the echidna will become more numerous, and in the wild regions of the Blue Mountains it will probably long have a retreat which will be away from the track of advancing civilisation. Most of the specimens seen are those that have wandered from the wild regions of mountain and gully into the cleared sheep-pastures or cattle-paddocks. When an echidna is seen walking about, its movements recall those of the tortoise. The gait is clumsy, and the limbs are moved with apparent mechanical deliberation. The animal has evidently little feeling of danger, as if conscious of its own superiority to all attacks. When undisturbed, it walks with its head well forward and the spines quite flat along the back, occasionally lifting its snout high in the air, sniffing, as if to try and catch the scent of ants carried by the breeze. When taken into captivity, its bids for liberty are most persistent and rather annoying. A cage is perfectly useless, as the animal at once tries to force a passage through the wires. Unless the wires be firmly twisted together, as in wire netting, it is almost certain that ere long the echidna, with its enormously powerful fore-limbs, will have torn the wires apart and made good its escape. Should the wires prove the stronger, the echidna, apparently indifferent to pain, will continue hour after hour trying to force a passage, tearing the skin from the sides of its head and snout. One specimen left in a box, with wooden spars nailed across the top, in a few hours had wrenched off two of the spars and made its escape. After trying various sorts of boxes, I succeeded in finding a satisfactory means of keeping the animal, namely, a strong canvas bag. In this the echidna is powerless, as he can get no foothold, and even though the bag be closed as tight as possible there is apparently enough air admitted to keep the animal alive.

"When an adult echidna is captured and placed in confinement, he will most probably refuse all food or drink for some days. Usually a week will elapse before he will condescend to take even water. So great is their power of endurance that they will keep in fairly good condition without food or drink for five or six weeks. When once the captive can be induced to take water, it can be comparatively easily tamed. Milk it becomes very fond of, and if finely minced raw meat be mixed with the milk, a diet can be provided which is apparently well relished, and on which the animal thrives. I have found it most suitable to give a good meal only once in the two days. A large adult will easily take an ordinary tea-cupful of milk and mince-meat.

"If an echidna be placed on an ants' nest it at once sets to work. Seated on a tripod, formed of the two hind legs well advanced and the little stumpy tail, it uses its front feet and its snout for opening up the various passages. The long sharp snout is thrust down one of the passages, and from it the long vermiform tongue sweeps out and in all the neighbouring passages, clearing them in a few seconds of all ants and eggs. The tongue can be put out about 4 inches, and has a curious power of following the exact curves and twists of the passages. When the snout is deeply pushed into a passage, the point of the tongue will be seen whipping out and in other passages 2 or 3 inches away. When the ants have been cleared out of all the passages, the long front claws are pushed in by the side of the snout, and the passage forcibly opened up, allowing the snout to go an inch or so deeper. The pupæ and larvæ seem to be especially relished, and seem always to be preferred to the ants themselves.

"In the Taralga district the echidna seems to breed about September and October—considerably later than in the warmer parts of Australia, where July is apparently the usual season. One or two eggs are laid about twenty-seven days after pairing. When the egg is laid the degreee of development of the embryo corresponds roughly to that of a third-day chick or a ten-days' rabbit. The amnion is not closed, and the allantois has apparently not begun to form. It is probably a couple of weeks later before the egg is hatched. During the period of incubation the egg is carried about by the mother, placed in the bottom of the temporary pouch, and secured by the abdominal hairs plastered across it. After hatching, the young is apparently carried about till it is a good size, and able to look after itself."

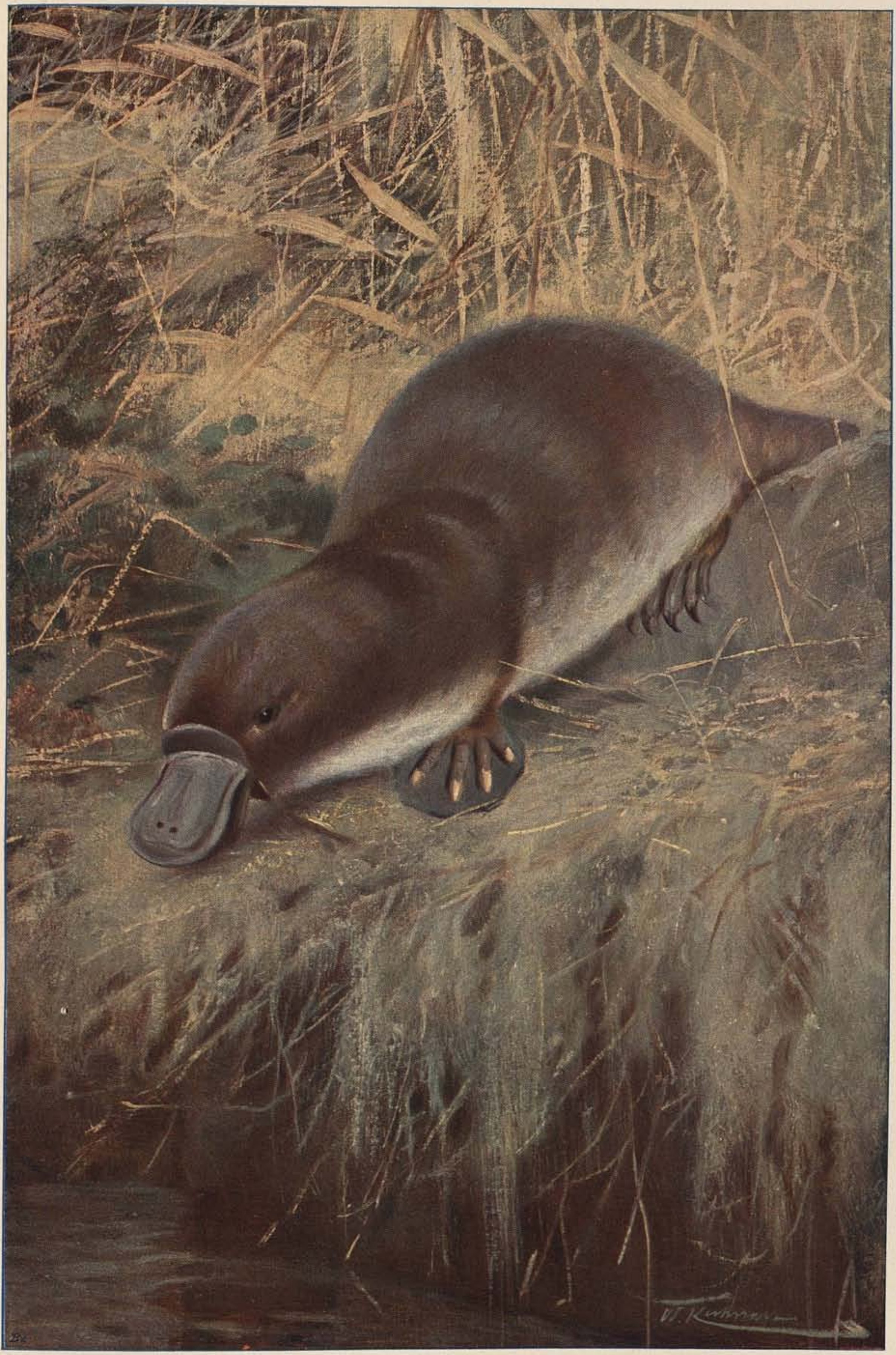
Echidna aculeata is common to Tasmania, the whole of Australia, and New Guinea, although each country has its own local races. The Tasmanian race (*E. a setosa*), for example, has more hair and bristles between the spines than the typical echidna of the Australian mainland, while the Papuan representative of the species (*E. a. lawesi*) carries more spines on the head. The Tasmanian echidna, which is the largest, measuring about 20 inches in length, has also a shorter beak and spines, the latter being in some examples almost completely buried in the dense coat of dark brown hair, which is marked on the breast with a couple of white spots. All the races have five claws to the feet, those of the front pair being broad and nail-like, while those behind are narrow and strongly curved.

Platypus, or Duckbill.

The uncouth skin-clad beak from which the duckbilled platypus (*Ornithorhynchus anatinus*) derives the first half of its name serves to render this animal absolutely unmistakable at the first glance. So different is it from the echidnas, that it is referred to a separate family, the *Ornithorhynchidæ*, of which it is the sole living representative, although a second has been named on the evidence of fossil remains from the superficial formations of Australia. In length the duckbill measures about 18 inches, or, inclusive of the tail, nearly 2 feet; and is of a stout and bloated appearance, the body being rounded and somewhat depressed. The coat consists of short, velvety black hair; external ears are lacking, and the eyes are relatively small. Like those of the spiny anteater, the males are furnished with a hollow spur, connected with a gland, on the hind-leg, which appears to have poisonous properties. Although in stuffed specimens the broad, depressed, and terminally expanded beak looks hard and horny, in life it is covered with a soft and sensitive leathery skin, with a fringe, which appears to be also sensitive, round its base. In all the older works on natural history, as well as in most modern ones, the duckbill is represented as crawling or basking either on the branch of a tree stretching over water from the bank or on the bank itself. This is, however, utterly untrue to nature; the creature never voluntarily leaving the water except to enter its burrow by way of the submerged entrance. Another universal pictorial error appears in connection with the fore-feet, the five toes of which are connected by a web projecting considerably beyond the tips of the claws. In pictures the animal is represented as standing when on land with this web fully expanded, so that the claws do not touch the ground; but this is evidently an impossible pose, and it appears that when the animal leaves the water the front edge of the membrane is folded backward beneath the sole of the foot so as to leave the claws free. In the hind-feet the membrane is smaller, reaching only to the base of the claws. The rather short tail is clothed with coarse hair, but in old age frequently becomes bare on the under side. The food, which in early life at any rate chiefly consists of snails, shrimps, and aquatic insects, is conveyed after passing the edges of the beak into a pair of capacious cheek-pouches, between which lies the short tongue. For the purpose of masticating their food, young and half-grown duckbills are furnished in each jaw with three pairs of cupped and cusped crushing teeth of an altogether peculiar and unique type, although with a distant resemblance to those of certain small extinct mammals from the Oolitic and Triassic formations of Europe. In appearance these teeth may be compared to small square dishes, with two small knobs on one side and a row of notches on the other; with constant use these teeth, which are very short-crowned, gradually become completely worn away, and are shed. Their function is then discharged by broad horny plates attached to the roof of the mouth and the edges of the lower jaw, these originally forming the beds on which the teeth rested. In the upper jaw there is one pair of broad horny plates behind and a smaller and narrower pair in front.

The range of the duckbill is limited to Australia and Tasmania, and is generally stated not to extend farther north on the mainland than 18° S. latitude. Later investigations have shown, however, that in some parts of the country this limit is considerably exceeded, duckbills having been obtained in Queensland so far north as the Trinity Bay district, in latitude 16° 45′ S.

In addition to the normal use, the duckbill takes advantage of its capacious beak as a means of carrying grass, leaves, and other materials for lining the dwelling and nesting-chamber at the termination of the burrow, where the accumulation is rolled up into a ball-like mass. When burrowing, the animal chiefly makes use of the broad and flattened fore-paws. The burrow itself consists of a chamber with two openings, one above and the other below the surface of the water, the former being concealed amid the grass of the bank. The passage to the globular terminal chamber may be as much as 16 yards in length; in the chamber itself, which is jointly occupied by the two sexes, are laid

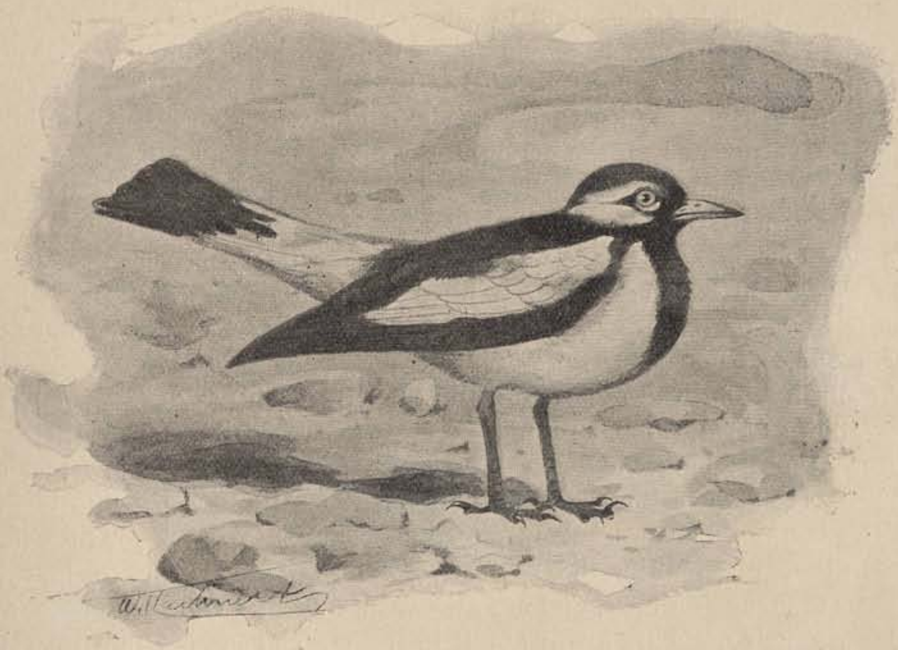


DUCKBILL.

the pair of eggs, these being enclosed in tough, flexible, white shells, and containing proportionately large yolks. How long these eggs are in hatching has not yet been ascertained; but the newly hatched young are known to be quite blind and naked, and furnished with soft, fleshy margins to their mouths, admirably adapted to receive the milk as it oozes from the breast of the female parent, or to suck it up as it floats on the surface of the water, on to which it is ejected when the young ones are old enough to follow their parents into the streams.

Some Perching Birds.

Australia, it has been remarked, is noticeable on account of the extraordinary and apparently unique richness of its bird fauna, for not only has the country its own peculiar types of interesting birds, such as emeus, mallee-birds, the black swan, laughing jackass, cockatoos, many parrots, lyre-birds, bower-birds, etc. (some of these being common to New Guinea), but it contains representatives of nearly every widely spread family of birds with the exception of vultures and woodpeckers. Nevertheless, in spite of this numerical richness, the birds of Australia are far less peculiar and characteristic than its mammals, although they include a considerable number worthy of special mention. To select those best worthy of such notice, more especially in the case of the perching and picarian groups, is however a matter of no little difficulty. Many Australian birds, it may be observed, are migratory, and it has been stated that no fewer than forty-eight species visit Siberia, although three of these are only occasional stragglers to the far north. Of these some ten or eleven breed not only in Siberia, but likewise, although perhaps in slightly different forms, in Australia.



PIE-LARK.

In the perching or passerine group mention may be made of the pie-lark (*Grallina picata*), which, like the Indian, Chinese, and Papuan members of the same group, presents considerable resemblance to a wagtail. Very delicately and beautifully plumaged birds are the so-called superb warblers, among which *Malurus cyaneus* has the enamel-like feathers of the back pale blue and velvety black, while the throat is blue-black and the under surface bluish white. Closely allied is the pheasant-tailed warbler (*Stipiturus malacrurus*), representing an exclusively Australasian genus belonging to the thrush family, in which the tail is formed of sixteen feathers with open webs. Omitting mention of the tit-mice, as being of no special distributional interest, the flower-peckers (*Dicœidæ*), which are common to the Oriental and Australasian regions, and perhaps also to West Africa, have an exquisite representative in the well-known diamond-bird (*Pardalotus affinis*), which is about the size of a wren, with a thicker beak than its relatives. With the exception of one outlying species in Bali, and others in Celebes, the honey-peckers, *Meliphagidæ*, of which the Australian scarlet and black soldier-bird (*Myzomela sanguinolenta*) is a striking representative, form an exclusively Australasian family with some two hundred species. These birds take their name from feeding on the honey in the flowers of blue gum-trees. The larks (*Alaudidæ*) have a single representative in the shape of the Australian field-lark (*Alauda australis*), and the pipits have but few Australian species, while the true finches (*Fringillidæ*) are totally wanting. In the economy of nature the place of the group last mentioned is filled by the weavers and weaver-finches of the family *Ploceidæ*, which, as we have seen, is common to the Oriental and Ethiopian regions. As well-known Australian representatives of the group may be mentioned the zebra-finch (*Amadina castanotis*) and the reed-finch (*A. castaneothorax*). The wood-swallows (*Artamidæ*), ranging as far west as India, and characterised by their conspicuously long wings, recalling those of the true swallows, which these birds resemble in general habits, have numerous Australian representatives. These haunt the banks of rivers and open plains, where they hawk for flies, in pursuit of which they often skim the surface of the water. They are, however, less swift than the true swallows, and are awkward on the ground on account of their short legs. Their nests are always built in trees. The species known as *Artamus superciliosus*, a bird grey above and rusty brown below, is a good example of the group. The naked-lored orioles of the genus *Sphecotheres* have several Australian representatives, while the golden oriole of Europe also visits the antipodes.

Birds-of-Paradise and Bower-Birds.

With the exception of an outlying species in Madagascar, the gorgeous birds-of-paradise (*Paradiseidæ*) form an exclusively Australasian group, distinguished from their supposed relatives the crows by the form of their feet and nostrils and the long wire-like feathers with which parts of the plumage are decorated. The group is more fully noticed under the heading of New Guinea, which is its headquarters.

Much the same remark applies to the bower-birds, which are included by some writers in the *Paradiseidæ*, while by others they are assigned to a family by themselves, the *Ptilonorhynchidæ*. These birds, which attain their greatest development in New Guinea, derive their name from their remarkable habit of constructing bowers, or "runs," during the breeding-season, in which both sexes disport themselves for a time. The two or three eggs are, however, laid in a nest of twigs some distance away from the bower. Among the dozen or so of

Australian representatives of the group, the satin bower-bird (*Chlamydodera holosericea*) is a well-known type, somewhat larger in size than a missel-thrush; the plumage of the cock being deep shining blue, and that of the female greyish green above and whitish yellow beneath, with stripes of blackish grey. Of this bird, according to a local observer, the scrubs on the sea-coast form the favourite haunts. Occasionally these birds come out to the open forest to feed upon the berries of the mistletoe, or on the figs in gardens. The note is a clear whistle from tenor down to bass. Before nesting begins, the birds build up a play-ground, or bower. The finest bowers in nearly all cases are situated on the sunny side of a lying log, the ground being strewn with moss, flowers, yellow and blue lory-feathers, small bones, and snail-shells, for about a yard in diameter. In the middle is erected a bower about 18 inches in height. When completed, several birds of both sexes run round and through the archway or avenue, picking up some of the materials and tossing them about, and in this way apparently choosing partners. In the case of the nearly allied spotted species (*C. maculata*) of Queensland, New South Wales, Victoria, and South Australia, the same naturalist states that the bower is unlike the edifice of the satin-bird, which is closed on the top, but open. A cartful of bones—the vertebræ of sheep predominating—pieces of glass, unripe wild fruit, even a shilling sometimes, betray the entrance of the bower. In the case of the yellow-spotted bower-bird (*C. guttata*) at the commencement of the breeding-season several individuals sometimes resort to the same play-ground, where the adult males make a nuptial display. The dimensions of one play-ground were 7 by 5 feet. The foundation was a mass of twigs, which raised the floor of the arch about 6 or 8 inches above the general level of the ground, the walls of the arch being some 18 inches in height and 6 inches in thickness, while the total length of the intervening run was approximately 25 inches. In this run were placed thirteen flakes of limestone, together with about the same number of small green pods and a few beans, but no feathers or shells. The nests, which were built of twigs and placed in casuarina trees near the run, each contained a pair of heavily scribbled eggs. Great difference prevails in the various genera in regard to the form and decorations of the bower. In the satin-bird group, as we have just seen, bones take the chief place in the ornamentation, next to which come shells, small pebbles, berries, fruits, and scraps of metal; much the same thing occurring in the case of the typical bower-birds of the genus *Ptilonorhynchus*. On the other hand, among the species of the genus *Prionodura* flowers alone enter into the scheme of decoration, so that the bowers approach in character those of the Papuan gardener-bird (*Amblyornis*), referred to in the next chapter. Very interesting is the fact that the tooth-billed bower-bird (*Scenopœetes dentirostris*) forms a connecting link in this respect between the more typical members of the family and the so-called cat-birds, as typified by *Ælurodus viridis*, which also belong to the present group. In place of making a true bower, this bird merely clears an open space, which is decorated with leaves, laid, for the most part, wrong side uppermost. In one case the play-ground was situated among a tangle of "lawyer-palms." This play-ground, which was of considerable size, had been cleared of dead leaves, and was kept scrupulously clean; but when visited a number of large fresh leaves were strewn over it, apparently as ornaments. In the morning all the birds were noticed low down amongst the scrub, quite close to the play-ground, whilst towards sundown they were invariably perched high up amongst the topmost branches of the trees, but still in the immediate neighbourhood. This species, which is restricted to northern Queensland, is stated to excel all other bower-birds as mimics, and may be fitly termed the master mocking-bird of Australia. Not only will it imitate the note of every bird in its neighbourhood, but so closely does it do so, that other species are drawn to it as if to one of their own kind; this being especially the case during the breeding-season in May. The dancing-ground is unique, a small portion of the ground of the scrub being rendered perfectly bare for the space of a square yard or so, except for the presence of seven to nine large leaves, placed there by the bird, and with which it plays. These leaves, which are those of a particular kind of tree, are renewed every morning. As a general rule, during the height of the breeding-season these birds do not visit their play-grounds or indulge in mimic vocalisation in the daytime, but reserve the latter performance for the periods before sunrise and after sunset, when they are in the tree-tops. During the nesting-season the play-grounds are silent, unoccupied, and, most significant of all, untidy.

Cat-birds, on the other hand, neither clear a space nor construct a bower. Writing of the green cat-bird, Mr. A. J. Campbell, of Melbourne, states that "this most extraordinary bird is a denizen of the thick jungle-like scrub which clothes portions of the coastal regions of New South Wales and southern Queensland. During my visit to the Big Scrub of the Richmond River district, the peculiar voice of this bird was heard everywhere throughout the locality. The cry is a real cat-like 'mew-mew,' with a strong accent on the second 'mew,' as if some one had trodden on a cat's tail. I happened to observe a pair of birds 'caterwauling' about a nest, which was situated about 15 feet from the ground, in a small tree on the bank of Pearce's Creek. I climbed to the nest, only to be disappointed in finding a pair of young, clothed in down as black as ink, instead of a set of the rare, cream-coloured eggs." The other representative of the genus is the spotted cat-bird (*Æ. maculosus*) of northern Queensland. Another generic type is represented by the regent-bird (*Sericulus melinus*), which is mainly confined to the sub-tropical coast scrubs of the northern portion of New South Wales and southern Queensland, but its extreme southern limit appears to be Port Jackson in the south, where the bird has been occasionally observed, and the Fitzroy River in the north. The regent-bird, especially the adult male with its glorious black and golden orange plumage, is one of the handsomest of Australian birds. The young male resembles the more sombre female; in the second year the beak turns yellowish, and in the third year the plumage is complete.

Apparently the largest bowers of all are those constructed by Newton's bower-bird (*Prionodura newtoniana*), which may exceed 8 feet in height, and are decorated with flowers, more especially, if not exclusively, orchids. The adult male of this species is one of the most beautiful of the bower-birds, rivalling in its golden splendour the regent-bird. It is a native of the northern scrubs of Queensland. From the observations of local naturalists it appears that the bower is usually built on the ground between two trees, or between a tree and a bush, and is constructed of small sticks and twigs. These are piled up almost horizontally around one of the trees in the form of a pyramid, rising to a height varying from 4 feet to 6 or even 8 feet. A similar pile of inferior height—about 18 inches—is then built around the foot of the other tree; the intervening space being arched over with stems of climbing plants, and the piles decorated with white moss, and the arch with similar moss, mingled with clusters of green fruit resembling wild grapes. Through and over the covered run play the birds, young and old, of both sexes. The completion of the massive bower is, however, insufficient to arrest the architectural impulse of its owner, for scattered around are a number of dwarf, hut-like structures—which seem to be built by bending towards each other strong stems of standing grass, and capping them with a horizontal thatch of light twigs. In and around these gunyas, as they are termed by the natives, and from one to another, the birds in their play pursue each other to their heart's content. During the nesting-season the bowers are tenanted only by the male birds, the females having duties which demand their presence elsewhere.

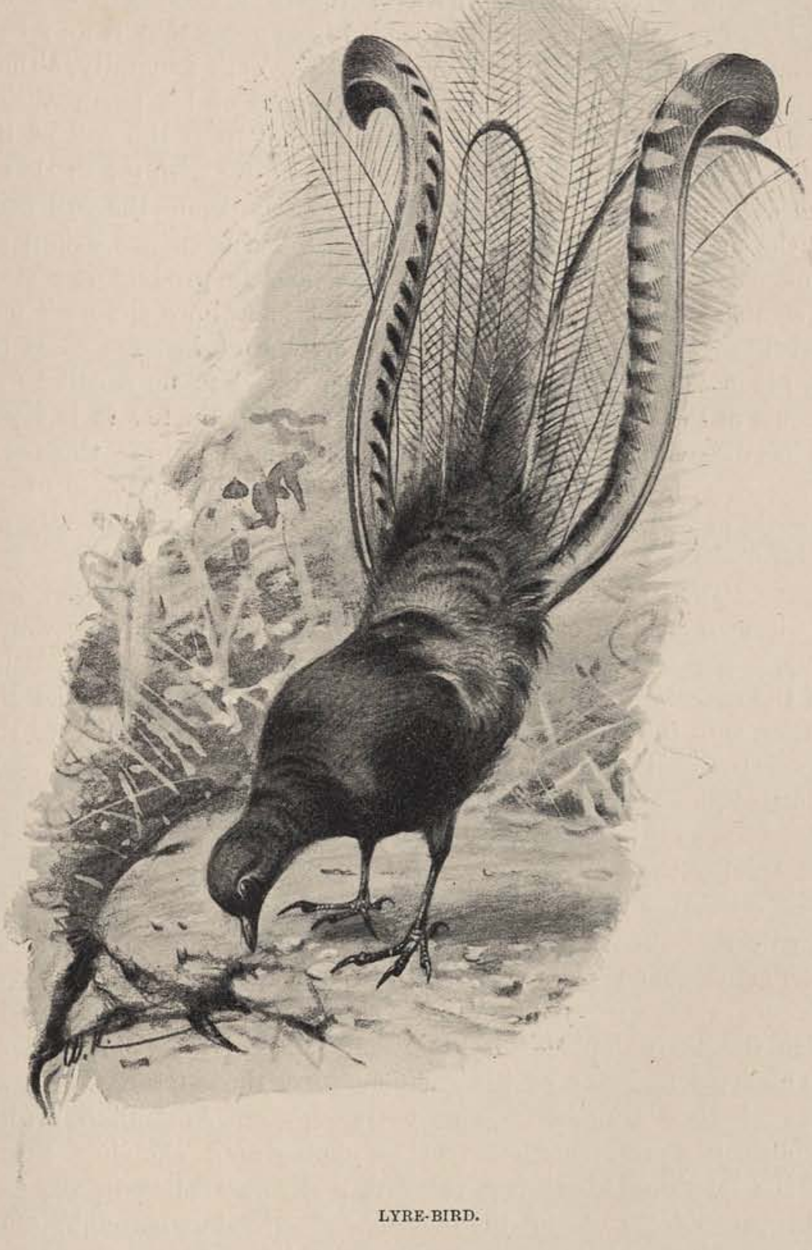
PIPING-CROW.

Crows and Piping-Crows. In the crow tribe, or *Corvidæ*, the mountain-crow (*Cercocoronus melanorhamphus*) is the Australian representative of the choughs of Europe and Asia, although belonging to a genus by itself. In colour it is black above and white beneath, as well as on the under-side of the wings, while the legs and feet are black. Allied to the magpies and jays of other regions is the so-called bullfinch-jay (*Brachyprorus cinereus*), a bird which in appearance much resembles a jay, but is of smaller size, and grey in colour, with dark brown wings and a glossy black tail. It is remarkable for building a nest of clay in the shape of a bowl. The Australian crow (*Corvus australis*) may be only a local race of the European species. The so-called Australian magpie, piping-crow, or organ-bird (*Gymnorhina organica*), is, on the other hand, an exclusive and characteristic Australian type. About the size of an ordinary crow, with a pied plumage, it is famed for its loud notes and wonderful power of imitating not only the human voice but the sounds of musical instruments. This bird ranges all over Australia, but there are two other species in that country and a third in Tasmania. Although these birds have been classed with the crows, there is considerable reason to believe that their proper position is in the shrike family (*Laniidæ*).

Scrub-Birds. Here may be mentioned the rufous scrub-bird (*Atrichornis rufescens*), which, together with *A. clamosa* of western, and south-western, Australia, represents a family group, the *Atrichornithidæ*, of low Passerines. The first eggs of this species known to science were discovered in the high Dorrigo scrubs at the head of the Bellinger River, New South Wales. The nest is a large dome-shaped structure, with a tubular entrance built amid thick bush in a tussock of dead carex-grass, and is constructed of this grass and leaves, with a lining of a hard dry material made of wood-pulp, upon which the two eggs rest.

Lyre-Birds. Another and more aberrant family—the *Menuridæ*—of perching birds is formed by the Australian lyre-birds, of which the most common species (*Menura superba*) may be compared in size to a pheasant. The feature from which these curious birds take their name is the lyre-like form of the long tail-feathers, which are generally carried upright. When singing, these birds spread their tails in peacock-fashion and droop the wings. They imitate to perfection the notes of other birds, and associate in pairs, each of which has a special territory, where they remain constantly during the breeding-season. The lyre-shaped tail is the exclusive prerogative of the adult cocks, females and immature males having tail-feathers of normal form. Not till the lyre-shaped plumes are fully developed—a feature which does not take place till the fourth year, when the central pair attains full perfection—do the cocks commence to sing. Sad to say, lyre-birds in some parts of the country, notably Victoria, stand in imminent danger of extermination. The Victorian lyre-bird, which represents a species (*M. victoriæ*) by itself, is restricted to the densely timbered, moist, mountainous tracts of the colony, where insect-food is abundant, and the bird is consequently local. In south Gippsland a few years ago these birds were to be met with in thousands, so that the woods re-echoed with their songs. How such birds attained this great development, when it is remembered that they nest on the ground, and that predatory marsupials were equally common, is not easy to surmise, but such is the fact. Now, however, the days of the lyre-bird appear to be numbered, unless it should develop the habit of nesting in trees habitually instead of only now and then. In most parts of Victoria its greatest enemy is the European fox, which has overrun the greater part, if not the whole of the colony, where it has developed the habit of ascending inclined tree-trunks to a considerable height. Scattered feet and an occasional tail of lyre-birds attest the destruction attributed to foxes. In south Gippsland, on the other hand, the bird is stated to be doomed to extermination at the hand of man. Guns, forest-spoliation, and bush-fires are the active agencies in this instance, and such of the scrub as is left is now silent, instead of resounding with the lyre-birds' notes. With the disappearance of the scrub goes the lyre-bird, and as the district gets cleared only patches of scrubby country are left. Till they are burnt, these become the temporary home of such birds as have escaped the gun, the clearing, and the fire, but when the final clearing takes place the lyre-birds disappear for ever.

Coachwhip-Bird. Among other members of the widely spread family of babblers (*Timeliidæ*) the species locally known as the coachwhip-bird (*Psophodes crepitans*) is worthy of special mention on account of its resounding note. In describing this, a local naturalist observes that nothing startles the new-comer to Australia when travelling in the bush more than the loud whip-like crack which is heard from time to time in the most solitary parts of the forest. Nor is his astonishment lessened when he discovers that this sound is produced by a small bird scarcely exceeding 9 inches in length, with a greenish black plumage, showing



LYRE-BIRD.

a mottled white patch on the breast and a pair of such patches, without the mottlings, on the throat. Very characteristic of this bird is a dark erectile crest surmounting the crown of the head. Starting with a limpid, long-drawn sound, closely resembling the noise produced by the whirling of a whip-lash preparatory to its being swished through the air to terminate in the final crack, the male bird gradually merges its voice into the swish of the lash, ending in a loud, sharp, crack-like note. The volume of sound produced is so great that it may be heard a quarter of a mile away in the stillness of the bush. Very generally, although not invariably, the call of the cock is answered by the note of his partner. This is a double note, somewhat softer in tone and quite distinct from the call of the male, although quickly following, but not in any way blending with it; so that persons who have not carefully watched these birds do not associate the call of the hen with that of the cock some distance away. Indeed confusion has arisen owing to some ornithologists maintaining that all the notes are the product of a single bird, and not the combined utterance of the two sexes. Sometimes the cock makes the opening "swish," and does not finish with the crack, but in such cases he is not answered by his mate. The note of the cock is believed to be a call to ascertain the whereabouts of the hen, and when the note is not completed it is because one of the birds has discovered the locality of the other. Sometimes the female calls first, in which case she is never answered by the whip-crack note of the cock. Coachwhip-birds, of which there are several species, are not infrequently mimicked by the lyre-bird.

Frog-mouth. The wide-gaped frog-mouth (*Podargus australis*) is a well-known member of a family, *Podargidæ*, of so-called picarian birds, of which the typical genus and *Batrachostomus* are restricted to the Australasian region and some of the neighbouring islands, while *Ægotheles* ranges from the Malay and Philippine Islands to the Himalaya and Ceylon. The group is allied to the nightjars; the species named being a bird of about the size of a brown owl, with a brownish mottled plumage.

Kingfishers. The kingfishers, *Alcedinidæ*, include among other Australian species the well-known laughing-kingfisher, or laughing-jackass (*Dacelo gigas*), a member of a small genus restricted to Australasia. This bird owes its name to its remarkable notes, which recall weird laughter. The large and widely distributed genus *Halcyon* has likewise an Australian representative, while there are also species pertaining to the equally wide-spread *Alcedo*, among which the azure lapis-lazuli kingfisher (*A. azurea*) is one of the most striking. The great majority of the peculiar Australasian kingfishers are, however, natives of New Guinea. Some years ago an Australian ornithological journal published a reproduction from a photograph, showing the feeding-grounds of the laughing kingfisher, cat-bird, and noisy pitta in the Coolabunia pine-scrubs near Kingaroy, to the south-west of Maryborough, Queensland. Near the centre of the photograph is shown a large flat stone, around which is strewn an enormous mass of shells of *Helix cunninghami*, a large species in which the shell measures more than a couple of inches in diameter. The shells of these snails are broken by the birds on the boulder, and their luscious contents eaten.

Cuckoos. In the cuckoo tribe, *Cuculidæ*, the extraordinary channel-bill (*Scythrops novæ-hollandiæ*), of Australia, Papua, and the Moluccas, takes its name from the presence of two deep grooves on the sides of the beak. The head is grey, the back brownish, the under surface whitish with faint dusky barrings, and the bare region round each eye scarlet. Among other cuckoos, the widely spread *Cuculus saturatus* visits north-eastern Australia, while *C. pallidus* is peculiar to that continent and Tasmania, where two species of the allied genus *Cacomantis* also occur. *Mesocalius palliolatus* alone represents a genus confined to Australia, the Aru Islands, and the Moluccas, and most of the species of *Chalcococcyx* are also Australasian. In regard to the breeding-habits of Australian cuckoos, it has been stated that only an infinitesimal proportion of their eggs approximate in size, colour, markings, and shape to those among which they are laid. There are, moreover, numerous instances in which Australian

LAUGHING KINGFISHER.

cuckoos have laid in the nests of graminivorous birds, with the consequent starvation of the young. In other instances cuckoos lay in nests already containing eggs of their own species, while they also make use of nests too small to contain the young birds in comfort. It is concluded that, so far at least as Australian species are concerned, cuckoos, in place of possessing an instinct leading to the selection of suitable foster-parents, lay their eggs haphazard.

Parrots and Cockatoos. The parrot tribe is very strongly represented in Australasia, to which certain groups are more or less nearly restricted. Among these are the members of the lory group (*Trichoglossidæ*), which subsist chiefly on the honey of flowers, collected by means of their brush-like tongues. Common everywhere in Australia among shrubs and trees, these gorgeously coloured birds are specially partial to gum-trees, to which they often resort in swarms. A well-known example is Swainson's loriquet (*Trichoglossus novæ-hollandiæ*), which is blue, with the head and the centre of the under-parts green, and most of the remainder of the plumage red mingled with yellow. Although not such climbers as the typical lories of the more widely ranging genus *Lorius*, the loriquets are far more powerful on the wing. Even more characteristic of Australia are the grass-parraquets, a group distinguished by the great width of the tail-feathers, of which the two middle pairs are nearly equal in length. This group includes about 70 species, distributed over Australia, New Zealand, Polynesia, and the Malay Archipelago east of Celebes, and ranging farther north than most other parrots of the eastern hemisphere. They extend as far south as the Auckland and Macquarie Islands, and as far east as Tahiti. Less efficient climbers than other parrots, they enliven the extensive pastures of Australia, where they appear in vast flocks to feed on the grass-seeds which form their chief food. They lead a restless, wandering life, for so soon as a drought dries up the water and grass they disappear from their breeding-places in the smaller forests (where crevices in the gum-trees afford sites for nesting) and migrate across country until they discover another spot where food is plentiful. These pretty parrots surpass most of their relatives in the speed of their graceful flight; and many of them possess an agreeable voice, while some are even endowed with a melodious, though short song. By far the commonest of these flat-tailed parrots is the budgerigar (*Melopsittacus undulatus*), a species of the size of a canary, in which the cocks have the cere black, whereas in the hens the same surface is either brown or buff. In colour the budgerigar is chiefly green, delicately picked out with the fine waving black lines to which it owes its specific name. In many districts—the neighbourhood of Adelaide among the number—these parraquets are extremely abundant, and they are everywhere familiar as cage-birds. Another well-known species is the cockatiel (*Calopsittacus novæ-hollandiæ*), which, like the budgerigar, is the only representative of its genus, and is widely spread in Australia; its habits being practically the same as those of the other members of the flat-tailed group. Mention may also be made of the swallow-parrot (*Nanodes discolor*), so called from the rapidity of its flight; a species resembling lories rather than other parraquets in its habits, as it lives chiefly in trees, and prefers the honey from gum-tree blossoms to seeds. In many respects it may be regarded as intermediate between the broadtails and the lories; it inhabits south-eastern and southern Australia and Tasmania, and is the sole member of its genus.

The grass-parraquets of the exclusively Australian and Tasmanian genus *Neophema*, with more than half a dozen species, justify in most cases their popular name by their habits. One of them, the rock-parraquet (*N. petrophila*), breeds, however, on the coast of South Australia, especially on Goat Island in Kellidie Bay. That island, which is barely half an acre in extent, consists of soft limestone rock, rising in cliffs 20 feet high, the cliffs being honeycombed with holes and the flat summit strewn with boulders, some of which have been piled into cairns. On the cliffs many of the eggs of the parraquets are laid in holes a yard or so in depth, but on the summit of the island many clutches are to be found beneath flat stones which happen to be raised a few inches above the ground by fragments of rock. One nest was jammed in between two vertical slabs of rock close to the water's edge. The usual number of eggs in a clutch appears to be four, although the above-mentioned nest contained five young birds, and several nests were found containing only three eggs. The nestlings are at first clothed in a pale yellowish grey down, quite unlike the brilliant golden-green plumage of their parents. This is not the only parrot in the Antipodes which nests amid rocks, where the eggs, when not deposited in holes, form conspicuous objects evidently out of harmony with their environment. The second is the New Zealand parrot, which, as noticed in a later chapter, lays its eggs and rears its young high up in the mountains amid glaciers and snowstorms.

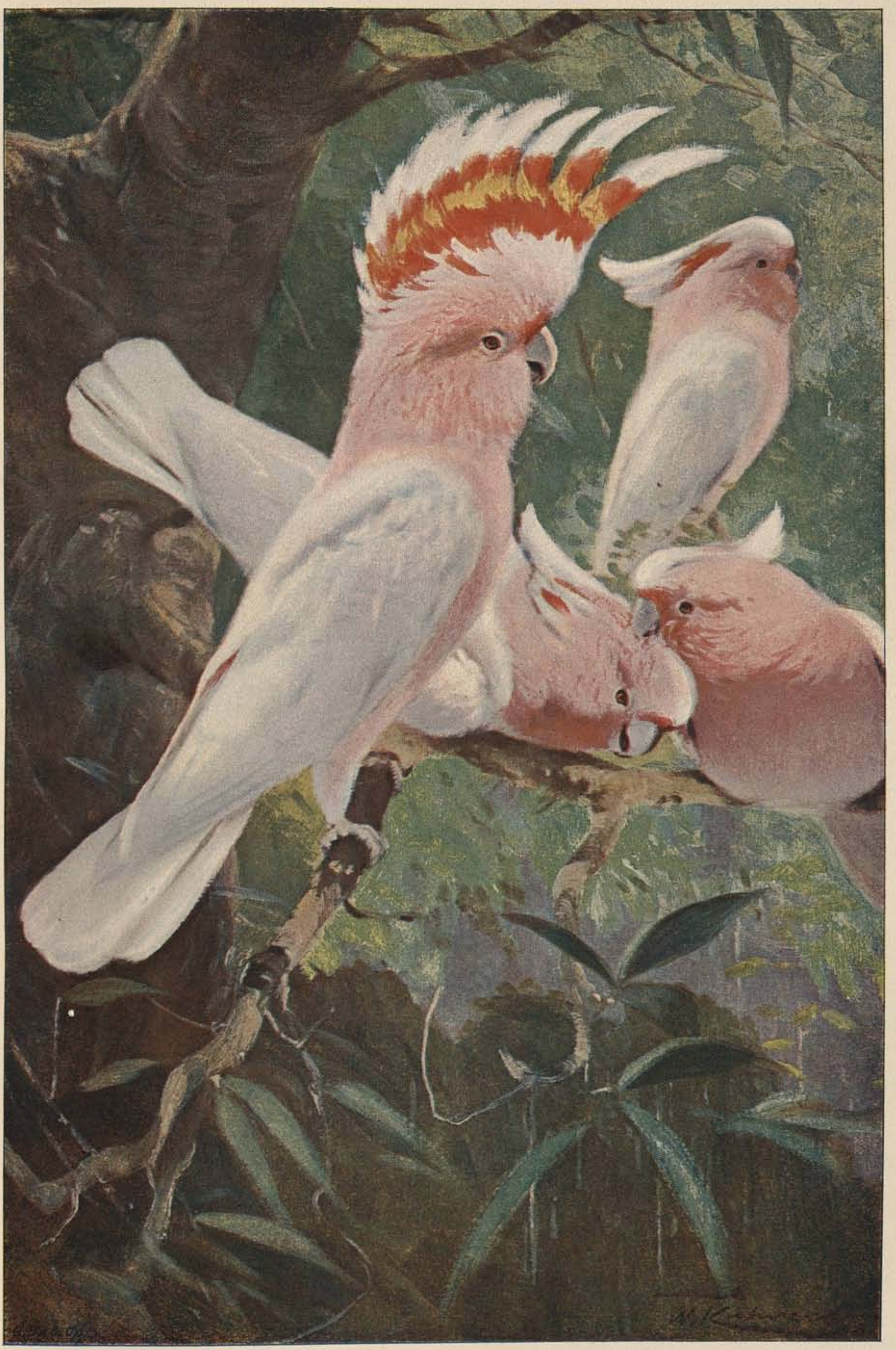
Another species that should be mentioned is the royal parrot (*Platycercus scapulatus*), one of the largest and most beautiful members of this group, which is nearly the size of a magpie, and has the head and under-parts bright scarlet, the back and wings dark green, the shoulders light green, the lower part of the back blue like the upper tail-coverts and a band round the neck, and the tail black. The beak is red at the base above, with the tip and lower half blackish. The female, on the other hand, is almost entirely green above, although the under-parts are red.

The cockatoos, *Cacatuidæ*, which are as essentially an Australian type as the broadtails, are sociable birds, frequently nesting together in large companies, and too well known to all to need much in the way of description. A curious fact in connection with the eyes of cockatoos is that while up to the age of about five years they are brightly coloured, those of male birds about that age turn black. The fact has an important bearing on the determination of the sexes in the great black cockatoo, *Calyptorhynchus banksi*. Cockatoos associate in large colonies, and nest either in holes in decaying trees or in rocky gullies; and at the close of the breeding-season these colonies take to wandering about the country, spending the night amid the foliage of the tree-tops, and starting again in the early morning in search of food. The nature of their food varies to a considerable extent in the different species. In the slender-billed group, for instance, of which *Licmetis nasica*, a South Australian species of the size of a rook, is a well-known example, the food consists chiefly of bulbs, which the birds dig out of the ground with their long beaks. As a second member of the same group, mention may be made of the somewhat larger burrowing cockatoo (*L. pastinator*) of Western

Australia. With a few exceptions, the more typical members of the family, such as the large sulphur-crested cockatoo (*Cacatua galerita*), so often seen in Europe, are mainly white. Leadbeater's cockatoo (*C. leadbeateri*) is, however, of a pale rosy tint. Very different is the mainly sable livery of the above-mentioned great black Banksian cockatoo (*Calyptorhynchus banksi*); while the ganga cockatoo (*Callocephalum galeatum*) is black with white edges to the feathers and a red crest and head.

With the ground-parraquet (*Geopsittacus occidentalis*) we reach a species characterised by its disproportionately large head and rather short tail, as well as by its abnormal habits. In place of frequenting trees, this parrot dwells in a subterranean hole, which it never quits till sunset, when it issues forth to feed. The swamp-parraquet (*Pezoporus formosus*), which is also nocturnal, is peculiar in laying its eggs on the bare ground. It frequents open, sandy districts covered with short grassy or marshy flats, and is chiefly a ground-bird, although when alarmed it takes to its wings and flies with great swiftness in a zigzag manner like a woodcock, soon, however, to alight and resume its course on the ground. From its relatives this bird is easily distinguished by the long, pointed wings and tail from which it takes the name of pheasant-cockatoo.

GREAT BLACK COCKATOO.



LEADBEATER'S COCKATOO.

Owls. The place of the European barn-owl is taken in Australia and the Melanesian Archipelago by the race or species known as *Strix delicatula*, as well as by the larger and silky-plumaged *S. novæ-hollandiæ.* The only other Australian owls are species of the widely ranging genus *Ninox*, such as *N. boobook* and *N. strenua*, other kinds occurring in Melanesia and New Zealand.

Falcons and Eagles. Among Australian diurnal birds-of-prey the red falcon (*Falco*, or *Cerchneis, cenchroides*) is a near relative of the lesser kestrel of Europe. Another falcon is the Berigora falcon (*Hieracidea berigora*), a member of a small genus represented by a second species (*H. orientalis*) in Australia and Tasmania, and a third (*H. novæ-guineæ*) in New Guinea. By far the finest of the Australian accipitrines is, however, the handsome wedge-tailed eagle (*Uroaëtus audax*), a species common to Australia and Tasmania, and only slightly inferior in size to the golden eagle. It is the only representative of its genus, and is a bold and predaceous bird, locally known as the eagle-hawk. Two species, *H. girrenera* and *H. sphenurus*, represent the genus *Haliastur*, the former ranging to New Guinea and the Moluccas, and the latter to New Caledonia. The white-headed osprey (*Pandion leucocephalus*) is the Antipodean member of a genus typified by the European osprey and including one other species.

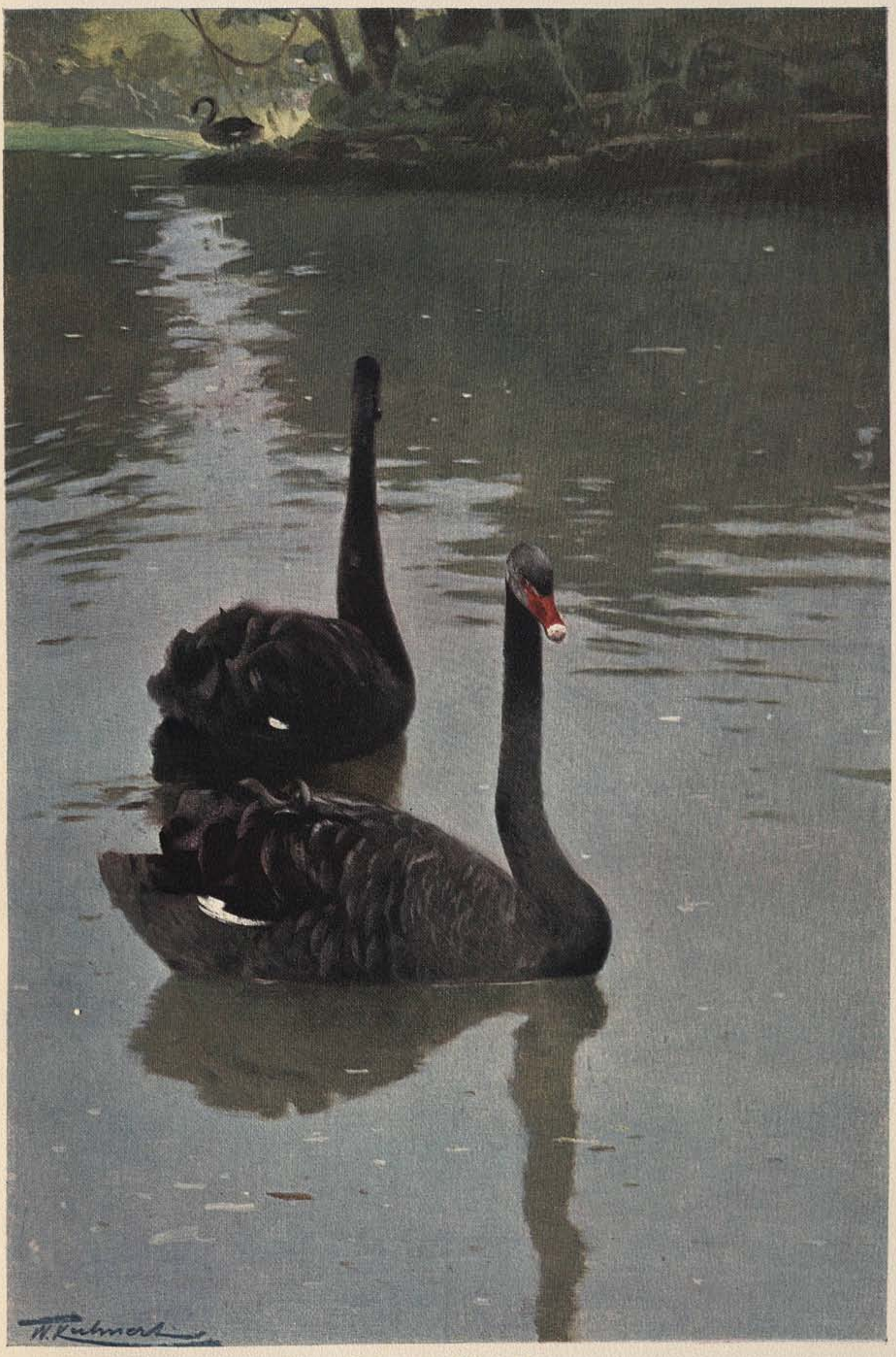
Plovers, Bustards, and Waders. In the typical section of the plover tribe (*Charadriidæ*) there are four generic types, severally represented by a single species, namely, *Erythrogonys cinctus*, *Zonifer tricolor*, *Peltohyas australis*, and *Cladorhynchus leucocephalus*, peculiar to Australia and Tasmania, while *Lobivanellus* is common to the Australian and Ethiopian regions. The avocets include one Australian and New Zealand species (*Recurvirostra novæ-hollandiæ*); and the European sanderling (*Calidris arenaria*), like several other waders, wanders in the northern winter so far south as Australia, where a representative of the painted snipe (*Rostratula australis*) is a permanent resident. The elegant jacanas have an exclusively Australasian and Malay genus in the shape of *Hydralector*, of which one species (*H. gallinaceus*) ranges from Australia to Celebes and southern Borneo, while the second (*H. novæ-guineæ*) is Papuan. Among the pratincoles *Stiltia isabella* forms a generic type ranging from Australia to Java, and *Burhinus grallarius* and *Orthorhamphus magnirostris* are distinctively Australian types of thick-knees. Bustards of the genus *Eupodotis* have a representative in *Eu. australis*, while *Antigone australasiana* stands for the cranes. *Carphibis spinicollis* and *Platibis flavipes* are respectively peculiar generic types of ibises and spoonbills, and *Leucophoyx candidissima* occupies a similar position among the egrets. In the latter group *Notophoyx*, with four species, of which the typical *N. novæ-hollandiæ* ranges from Australia to New Zealand, New Caledonia, Papua, and the Moluccas, is another mainly Australian genus; while the Indian and African *Mesophoyx* has also an Australasian representative (*M. plumifera*). European and Asiatic genera of egrets are represented by *Garzetta nigripes*, *Ardetta sumatrana*, and *A. cinerea*, all of which are wide ranging species.

In connection with egrets it may be mentioned that these birds, as in other countries, are subject to severe persecution for the sake of their lovely breeding-plumes, or "ospreys." A local naturalist, Mr. A. H. Mattingley, has given the following account of a visit to an egret-colony which had been recently raided by a party of these plume-hunters. The writer had visited the spot some months previously, when all was well, but on revisiting the place at Christmas it soon became evident that mischief had been done. "As we drew nearer, what a spectacle met our gaze—a sight that fairly made my blood boil with indignation. There, strewn on the floating water-weed, and also on adjacent logs, were at least fifty carcases of large white and smaller plumed egrets—nearly one-third of the colony, perhaps more—the birds having been shot off their nests containing young. . . . There were fifty birds ruthlessly destroyed, besides their young (about 200) left to die of starvation! This last fact was betokened by at least seventy carcases of nestlings . . . which had fallen from the nests into the water and been drowned; while in the trees above the remainder of the nestlings could be seen staggering in the nests." Some of these unfortunates fell from time to time into the water, others died of inanition as they sat, while yet others stretched out their necks in the vain attempt to attract the attention of others of their own kind as they flew by with food in their beaks.

Next to cassowaries and emeus the tallest bird in Australia is the Asiatic black-necked jabiru stork (*Xenorhynchus asiaticus*), the young of which are remarkable for the long period they remain in the nest. On August 30, 1908, a nest, at first supposed to be that of a sea-eagle, was descried high up in the scrub by a local naturalist, and was found to form a large flat structure composed of long, trailing shore-grass, and placed on a mass of creepers strong enough to bear the weight of the birds if they got out. It contained three young jabirus, judged to be about a fortnight old, which lay flat on the base of the nest, and made no attempt to move when handled. On September 6 and 13 other visits were paid to the nest, which was again inspected four weeks later, on October 11, when a successful photograph was obtained of the three young birds standing on their lofty platform. By this time they were nearly fully fledged, and it was judged that they would be able to fly by the end of the month, when they would be about three months old.

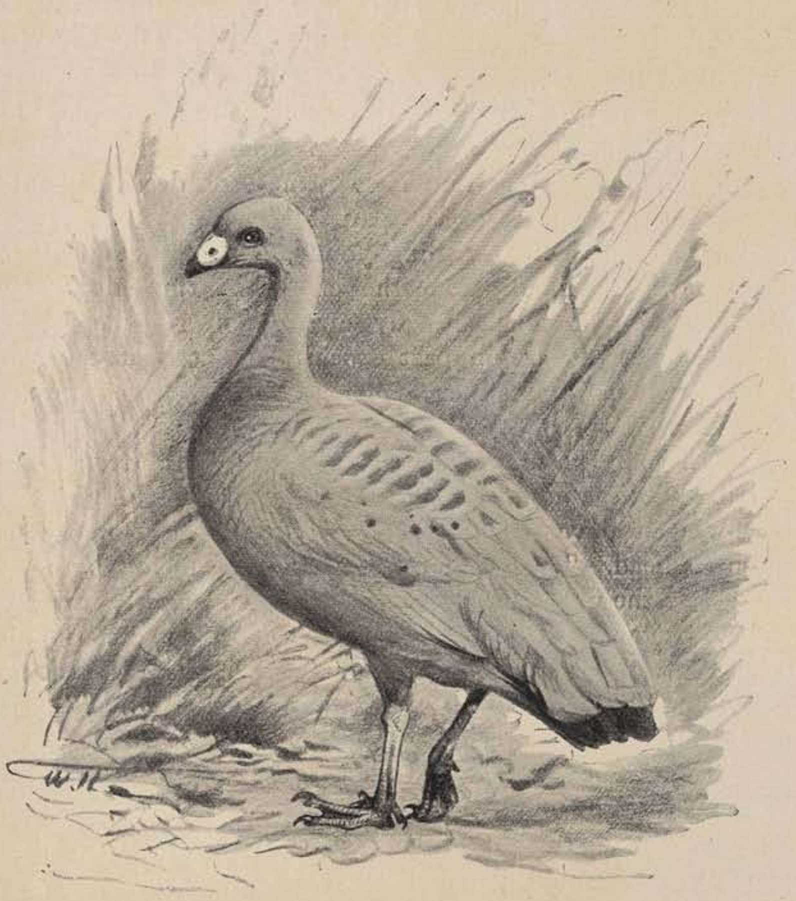
Water-birds.

Foremost and most striking among Australian water-birds is the black swan (*Cygnus atratus*), discovered by Willem de Vlaming in 1697 in the estuary of the Swan River of Western Australia. Despite its name, this swan is not, however, wholly black, since its flight-feathers are snowy white; but these are seldom seen, as the birds generally endeavour to escape from danger by swimming rapidly rather than by flight. A far more remarkable type is the Cape Barron goose (*Cereopsis novæ-hollandiæ*), the sole representative of its genus, and now rare on the mainland, although still common in Tasmania and the smaller islands. A greyish bird, with black spots on its wings, red feet, black toes, and a sulphur-yellow beak with a black spot, this goose is specially characterised by its short, arched, and truncated beak, covered at the base with a waxy skin, and its long legs. Swimming slowly, and flying heavily, the Cape Barron goose spends much more of its time on land than in the water. A third notable type in this group is the half-winged goose (*Anseranas melanoleucus*, or *semi-palmata*) conspicuous from its pied plumage, and oftener seen among trees than on the



BLACK SWAN.

water, its slightly webbed feet and long, sharp claws enabling it to perch with facility. Another notable Australian water-bird is the great musk-duck (*Biziura lobata*), distinguished by the marked superiority in size of the male over the female, and the presence of a large lobe of skin hanging from the drake's chin. According to a local observer, whenever a musk-drake utters its characteristic deep-toned note it at the same time throws up a jet of water on each side of its body by the action of its feet. On one occasion a wounded blue waterhen was observed making desperate efforts to escape the attack of a hawk. Gradually the waterhen approached a musk-duck which was swimming placidly in the neighbourhood, and when it got close enough sought protection by dodging first on one and then on the other side of the duck. After a few moments the latter began to take an active part in the combat by uttering its loud note every time the hawk made a stoop at the waterhen, at the same moment splashing up a backwardly directed jet of water in the eyes of the aggressor. Three times the hawk received a douche, after which it retired from the combat, leaving both the duck and waterhen in peace. This curious action is not peculiar to the Australian musk-duck, but is a regular habit with the local coot when attacked or threatened by a bird of prey; with this difference, that a number of coots will act in concert,



CAPE BARRON GOOSE.

and make a great splashing with their wings, which has the effect of driving their common enemy away.

In this connection reference may be made to a lake in the northern territory of Australia, which, according to another well-known local naturalist, Mr. le Souëf, appears to be a veritable death-trap for swans, pelicans, and other water-birds. Lake Buchanan, 80 miles distant from Pentland, is the piece of water referred to, this lake becoming filled to the brim during the rainy season, when it is the resort of thousands of aquatic birds for breeding purposes, including numbers of black swans and pelicans. It is, however, only in exceptional seasons that any of the two latter species ever get away alive, for with the advance of summer the lake gradually dries up, and, in the absence of any outlet, becomes intensely salt. In consequence of this, all the cygnets and young pelicans, together with hosts of fishes which have entered the lake from its influent creek during the wet season, perish miserably, and form a mass of decaying animal matter on its shores. Neither do most of the parent birds make their escape, as the majority remain to tend their perishing young, with the result that they also gradually become weak and ill from the effects of the salt water and lack of food, till they are too feeble to fly away, even if they had the will. Occurrences of a similar nature in past epochs may account for the enormous number of fish-skeletons and other remains of vertebrates found in many geological formations.

Pigeons. Among the numerous Australian representatives of the pigeon tribe (*Columbidæ*), mention may first be made of the beautiful crested bronze-winged dove (*Ocyphaps lophotes*), readily recognised by the pointed crest on its head. The common bronze-winged dove (*Phaps chalcoptera*), from which probably the preceding species has been generically separated without sufficient reason, is noteworthy on account of the enormous distances it is capable of flying without a rest. Both these genera, as well as *Histriophaps*, *Petrophassa*, *Geophaps*, and *Lophophaps*, are exclusively Australian. The same is the case in another group of the family with *Leucosarcia*, as represented by the well-known wonga-wonga dove (*L. picata*), of the eastern side of the continent, a species which it has been suggested might prove suitable for domestication. Among the group of fruit-pigeons are several brilliantly coloured birds, specially designated painted pigeons, the geographical distribution of which embraces Australia and New Guinea together with some of the islands of the Malay Archipelago and Polynesia. A well-known member of this group is Swainson's painted pigeon (*Ptilopus swainsoni*), a yellowish green bird with a rose-coloured crown and lilac breast-band inhabiting New South Wales.

Game-Birds. Although game-birds are by no means strongly represented in Australia, they include a few very characteristic types. Among widely spread groups are the Australian quail (*Coturnix pectoralis australis*), and the Australian swamp-quail (*Synœcus australis*), the latter belonging to a genus with four species, of which the collective range extends from Australia and New Guinea to the Lesser Sunda Islands. Far more interesting are the brush-turkeys or megapodes (*Megapodiidæ*), the distribution of which includes the islands of the Malay and Polynesian Archipelagoes as well as Australia and

New Guinea. The great peculiarity about these big birds is that, in place of brooding their eggs, they deposit them in huge heaps of leaves and other vegetable matter scraped together by their own powerful feet, where they are left to hatch by means of the heat produced by decomposition and fermentation. The cocks, which take the larger share in piling up these heaps, remain in the neighbourhood to watch over the eggs, and from time to time regulate the temperature of the mass by removing or replacing the leaves, after which they assist the chicks in freeing themselves from the shells of the eggs. For the first few nights of their existence the chicks are replaced by the cocks in the mounds, but in a short time they become more fully fledged, and are then able to shift for themselves. One member of the group, the Australian brush-turkey *Catheturus lathami*), will breed freely in captivity, if allowed suitable conditions. Megapodes are represented by one species in the Nicobars and a second in the Tessimber Islands, by others in the Philippines, Celebes, and other Malay islands, and by yet others in the Molucca, Louisiade, Kangeang, Kei, Aru, New Hebrides, Marianne, and other groups. In addition to these are the Papuan species, among which the true brush-turkeys are numerously represented. The only species, in addition to the one already mentioned, peculiar to the Australian mainland is the so-called mallee-fowl (*Lipoa ocellata*), of Western and South Australia, which is of the approximate size of a pheasant, with white cross-bars on the back and wings, and a white-tipped black tail. According to a recent observer, mallee-fowls do not begin to lay until two years old, and during the first half of the breeding-season the eggs are laid regularly every third or fourth day, after which the intervals between the deposition of the eggs increase according to the disposition of the individual birds and the amount of food available. Hot and dry seasons have a noticeable effect on these birds, which under such conditions lay fewer eggs than usual. Laying usually commences early in September, but may be deferred until December is well advanced, and the total number of eggs laid by the individual hens in a season varies from one to a score. The eggs have unpolished shells of a delicate salmon-pink or pinkish red colour when first

LATHAM'S BRUSH-TURKEY.

laid, but soon fade to earthy brown. They are laid in the mound in tiers, with four in the basement tier; between each tier is a layer of sand 3 or 4 inches thick, and the eggs in the same tier are separated from one another by from 6 to 12 inches of the same material, and placed near the solid wall of decaying vegetable matter bounding the egg-chamber. The eggs are always placed with the narrow end downwards, so that when hatching the head of the chick, which occupies the larger end, will be uppermost.

Cassowary and Emeu. The ostrich-like birds have two representatives in Australia, of which the Australian cassowary (*Casuarius australis*) belongs to a comparatively widespread group, more fully discussed in the chapter on the Papuan fauna. The second species is the emeu (*Dromœus novœ-hollandiœ*), which appears to be the sole existing representative of its genus, the so-called *D. irroratus* of Western Australia being, in the opinion of a local naturalist, not entitled to rank even as a distinct race. This well-known bird, which is exclusively Australian, comes next in point of size to the ostrich. In colour it is greyish brown, with the upper part of the bare neck bluish; and the plumage is long and shaggy, except on the nape of the neck, where it is replaced by short down. In the early days of Australian colonisation emeus abounded on the grassy plains, where they might be seen in the mornings searching for the grass and other herbage which, with roots and fruits, form their chief nutriments. At the present day emeus have, however, retreated to the interior, where they can still wander without molestation. Equal to the great grey kangaroo in point of speed, these giant birds will run till they succumb from sheer exhaustion, and when occasion arises do not hesitate to plunge into and swim across even wide rivers.

Although emeus commonly associate in small flocks, each cock mates with a single hen, whom he relieves from the duties of incubation by sitting on the dark green, granulated eggs himself. From nine to ten is the usual number of eggs in a clutch; and the chicks, like those of the ostrich group generally, are longitudinally striped, much after the fashion of those of their relatives the game-birds. During the breeding-season the hen utters a strange, subdued call, produced by means of a pouch, peculiar to her sex, communicating with the windpipe. Not only is the hen superior in size to her mate, but she is also more courageous and more prone to quarrel; the cock, on the other hand, is a swifter and at the same time a more gracefully built bird.

In former days certain islands in Bass Strait, such as Kangaroo Island and King Island, together with Tasmania, were severally inhabited by species distinct from *Dromœus novœ-hollandiœ* of the mainland. Both the Kangaroo Island *D. peroni* or *D. ater* and the King Island *D. minor* were darker than the mainland bird, the first being distinguished from the second by its less robust build. The Tasmanian emeu, which survived in numbers until at least as late as 1840, is still insufficiently described, but appears to have differed in colour from each of the other three species, and also laid eggs of a distinctive character.

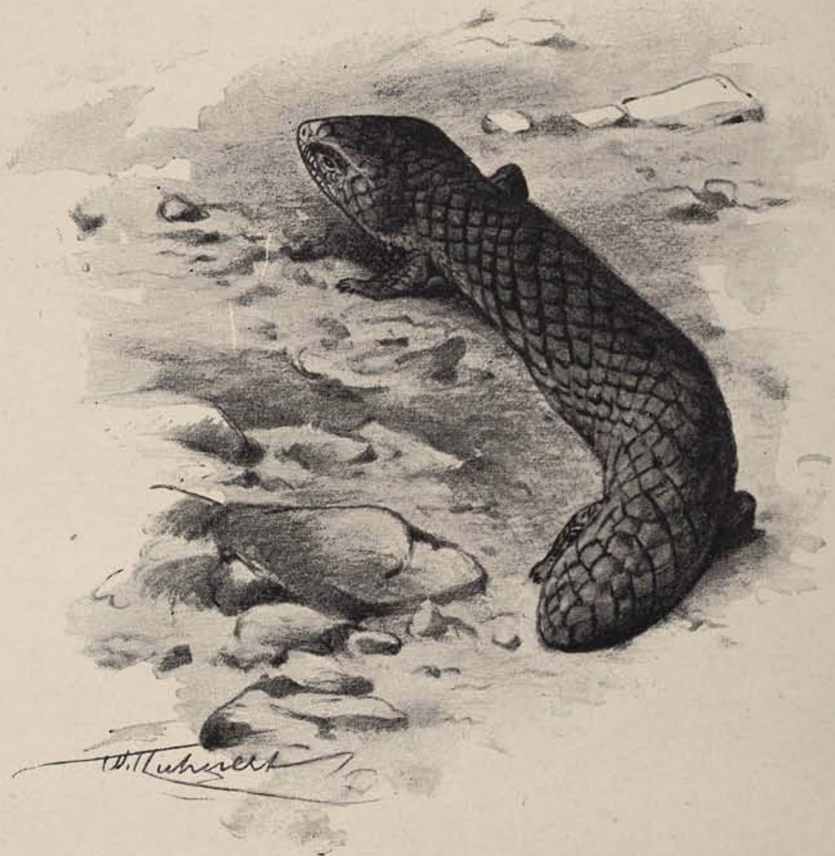
Reptiles. Among the rich reptilian fauna of Australia it is possible to refer only to a few of the more interesting types. Crocodiles are represented by *Crocodilus porosus*, a rather narrow-snouted species, ranging from India, Ceylon, and the south of China to northern Australia and the Solomon and

Fiji Islands. This wide distribution is accounted for by the fact that the species readily enters salt water, and is not infrequently found out at sea. Of land-tortoises and soft river-tortoises there are none; but the southern side-necked tortoises are represented by two generic types peculiar to the region, namely, *Chelodina* and *Emydura*, each of which is common to Australia and New Guinea, and includes several species. Mention may also be made of the huge extinct horned tortoise (*Miolania*), of Queensland, which is of special interest from a distributional point

THE EMEU.

of view on account of being represented by an allied species in the later Tertiary deposits of Patagonia, as already mentioned in the chapter on the fauna of South America.

In the lizard group the skink family (*Scincidæ*) attains a remarkable development in the region, one of the strangest forms being the stump-tailed skink (*Trachysaurus rugosus*), a lethargic reptile characterised by its thick, hard, overlapping brown scales, stumpy tail, and short legs. This lizard, which in appearance recalls an elongated fir-cone, is also characterised, in common with other skinks, by producing living young, generally two in number; but these are not enclosed in shells before birth, and are so fully developed and of such large size that they commence to feed immediately after their first appearance in the world. Of other skinks, it must suffice to mention that the genus *Cyclodus* or *Tiliqua*, specially distinguished by its large and flattened cheek-teeth, is common to the present region and the Malay Islands, and in New Guinea is represented by a species, *C. gigas*, which attains a length of 2 feet. Chamæleons and the lizards of the typical family *Lacertidæ* are absent, but the monitors are represented by the great *Varanus salvator*, of which the distribution is nearly the same as that of *Crocodilus porosus*, extending from India and Ceylon to the the Cape York Peninsula. This species grows to a length of 7 feet. The one family of lizards



STUMP-TAILED SKINK.

restricted to the region is that of the scale-footed *Pygopodidæ*, among which *Pygopus lepidopus*, with a coppery-grey colour and a length of about 2 feet, ranges all over Australia. In this snake-like reptile the limbs are reduced to scaly flaps, but in the allied Australian *Lialis burtoni* they form strips of such small size as to be almost invisible. The family is not improbably represented in New Guinea as well as in Australia.

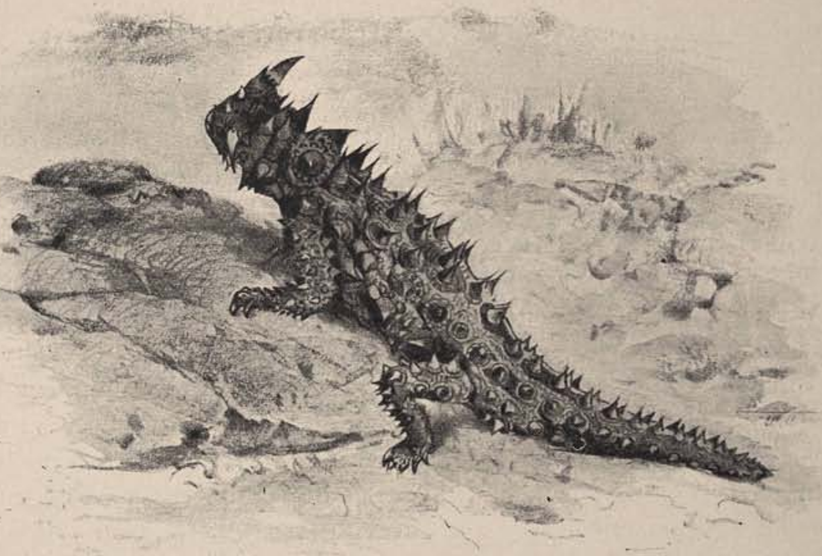
In Australia the place of the *Lacertidæ* is taken by lizards of the family *Agamidæ*, characterised by the teeth being situated on the summits of the jaws Among these it must suffice to mention three species, two of which severally represent a genus by themselves. The first of these is the brilliantly coloured frilled lizard (*Chlamydosaurus kingi*), a species of between 2 and 3 feet in length, provided with a large membranous frill or collar round the neck, which, under the influence of irritation or excitement, can be expanded so as to surround the neck like a halo. On the other hand, when desirous of escaping from danger, this strange lizard folds up its frill like an umbrella, assumes an upright posture, and scuds across the sand as fast as its legs can carry it. Whenever the frill is expanded the mouth is at the same time opened to its full extent, thereby adding to the reptile's terrifying appearance, so far at least as predacious birds and other enemies apart from man are concerned. On the running habit, which has been erroneously asserted to be peculiar to this species, although it is possessed in a minor degree by certain other lizards, has been based the utterly mistaken idea that the frilled lizard is related to the gigantic extinct dinosaurs of the Oolitic period. The species was discovered on the bough of a tree by a botanical assistant attached to the expedition under the command of Captain P. P. King which surveyed the coast of Western Australia from 1818 to 1822, and it ought therefore to have been named in his honour instead of after the commander.

Equally noteworthy and strange, although in quite a different way, is the spiny Moloch lizard (*Moloch horridus*), which is a depressed reptile of about 8 inches in length, completely protected from attack on the part of most enemies by the armour of stout horny spines covering head, body, and tail. In general appearance the moloch, which, like the frilled lizard, is the sole representative of its genus, presents a curious superficial resemblance to the so-called horned toads of America (*Phrynosoma*), belonging to the iguana family, and referred to in an earlier chapter. The moloch, despite its formidable appearance, seems to be a perfectly harmless reptile, feeding on ants, and being completely terrestrial in its habits, as indeed is sufficiently indicated by its depressed form of body. The protective power of its spines is increased by the power of changing the colour of its skin possessed by the moloch, this being modified according to the nature of its surroundings. Frequently these lizards may be seen to change the normal yellowish or dark brown of their skin to dark green when they quit sandy ground for green herbage, or *vice versa*.

The third representative of the *Agamidæ* which can be mentioned here is the bearded lizard (*Amphibolurus barbatus*), locally known as the Jew lizard. It is a member of a genus containing about thirteen other species, all of which are furnished with a transverse fold of skin on the throat. In the bearded lizard, if not in its relatives, this fold is capable of inflation so as to form a kind of frill on the throat; and in districts where the frilled lizard is unknown this species frequently usurps its name. Measuring about 21 inches in length, and having a depressed and expanded body, this lizard is brown in colour, frequently marked with darker bars on the back, and with either light or dark mottlings on the under surface.

Geckos (*Geckonidæ*), which range over the whole tropical and sub-tropical zone of the world, include several peculiar Australian generic types, which need not be further referred to on this occasion.

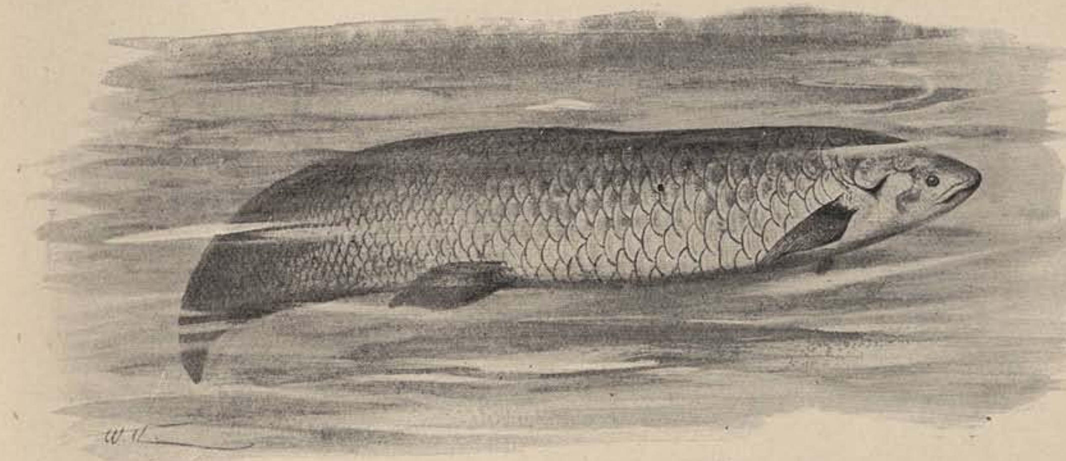
Turning to snakes, we find the pythons represented in Australia by the beautifully but variably coloured carpet-snake (*Python spilotes*), a species which is also common to New Guinea. In the *Colubridæ* the green whip-like tree-snakes appear in northern and eastern Australia in the form of *Dendrophis punctulatus*; while the mainland is also infested with various snakes of the poisonous elăpine group, such as the Australian black snake (*Pseudechis porphyriacus*), the tiger-snake (*Notechis scutatus*), and the death-adder (*Acanthophis antarcticus*); the last-named being easily recognised by the presence of a horny spine to the laterally compressed tail. All these genera are solely Australasian. The viper group, on the other hand, is absent from the region.



MOLOCH LIZARD.

Amphibians. In common with the southern hemisphere generally, Australia has no newts or salamanders, and the frogs or toads of the families *Discoglossidæ* and *Pelobatidæ* are likewise wanting. On the other hand, we find the family *Cystignathidæ* common to Australia and Tasmania in the eastern and to Central and South America in the western hemisphere. Of the peculiar Australian genera, *Chiroleptes* takes its name from the fact of the first front toe being opposable to the other three; *Heleioporus*, *Limnodynastes*, and *Pseudophryne* being other types. Toads of the family *Bufonidæ* occur in the region, although the typical genus *Bufo* is lacking; but in the tree-frogs (*Hylidæ*) the widely spread Australian *Hyla cærulea* is the largest local representative of the typical group. On the other hand, true frogs of the family *Ranidæ* enter the region only in the Cape York Peninsula. Finally, the cœcilians, or burrowing snake-like amphibians, are absent from the whole Australasian region.

Fishes. Very brief mention must suffice for the fishes of Australia, from among which, in common with the southern hemispheres in general, the salmon tribe (*Salmonidæ*) is entirely absent, while the essential southern genus *Galaxias*, of which one kind is marine, is represented by a single species. The so-called Dawson River salmon (*Osteoglossum leichardti*) is a near relative of the gigantic arapaima of the Amazons, and is the third member of a genus of which the other two are respectively Malay and South American. Most noteworthy of all is the Australian lung-fish (*Ceratodus*, or *Neoceratodus, forsteri*), which is likewise a Queensland fish, as it represents at the present day an absolutely unique type, and thus forms a parallel to the egg-laying mammals of the same region. These strange fishes, which grow to a large size, take their generic name from the presence on the palate and the opposing portion of the lower jaw of a pair of large dental plates, somewhat crescentic in shape, and carrying several strong and prominent ridges. Teeth of a similar type occur in the Triassic and Oolitic formations of Europe and India, and thus indicate the extreme antiquity of this group of fishes. Like the very different lung-fishes of Ethiopian Africa and tropical South America, the Queensland species is furnished with both lungs and gills, so that it is capable of living either out of or in the water. In addition to these altogether peculiar and characteristic species reference may be made here to the curious archer-fish (*Toxotes jaculator*), a fresh-water species ranging from the Indo-Malay countries to Australia and New Zealand, and the typical representative of the family *Toxotidæ*. These fishes have the power of squirting drops of water at insects on the vegetation on the banks of rivers, which are knocked by a successful shot into the water, when they are seized and eaten by the fish.

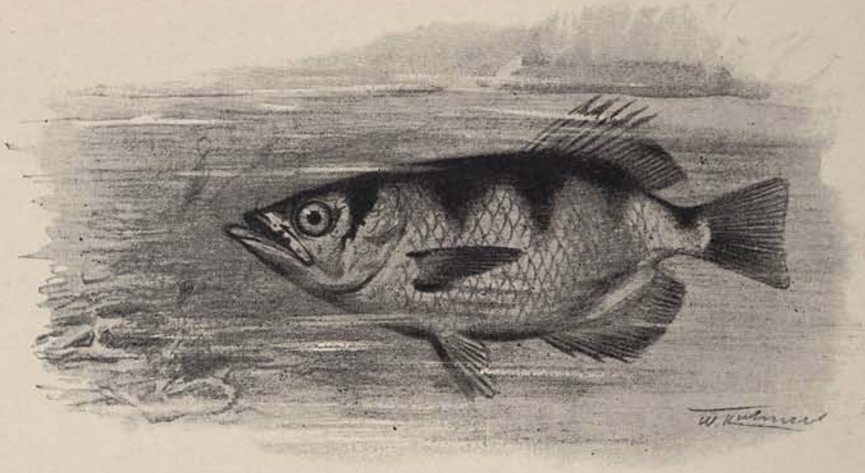


AUSTRALIAN LUNG-FISH.

It may also be mentioned here that Australia possesses a representative of the eels (*Anguilla australis*), which has much the same habits as its European relative, migrating for breeding purposes to the ocean, whence the young eels, or elvers, return to ascend the rivers until they find suitable dwelling-places. Like their European relatives, these eels, when prevented, by dams or on account of living in landlocked lakes or ponds, from reaching the sea by a direct route, will travel during freshets across flooded grass for long distances. Similarly, the elvers in Victoria not uncommonly ascend the streams in large companies, when, in case of a barrier intervening, they make their way over comparatively smooth surfaces of rocks.

Invertebrates.

Dealing first, and that very briefly, with the land molluscs of Australia, attention may be directed to the marked distinction from the rest of the continent, as regards its molluscan fauna, of the coast region extending from Cape York to Clarence River. The molluscan fauna of this area is quite unlike that of the whole of the rest of Australia and much closer to that of New Guinea, including as it does several Papuan generic types. In this respect the land snails of this part of Queensland agree closely with the mammals, many of which, such as tree-kangaroos and crescent-toothed phalangers, are likewise essentially of a Papuan type. The sea dividing this part of Queensland from New Guinea is, indeed, comparatively shallow, and there can be little doubt that, at no very distant epoch, geologically speaking, these countries were in direct communication with each other, while Queensland was at the same time cut off from the rest of Australia. From these and other considerations an American naturalist, Mr. G. W. Kirkaldy, who was for some time stationed in the Philippines, has suggested that the Australasian zoological realm should be divided into the following provinces:—



ARCHER-FISH.

(1) Austro-Malay, or Papuan, including, in addition to New Guinea, the Aru Islands, etc., the tropical forests of Queensland, New Caledonia, and the neigh-

bouring islands as far as Fiji; (2) Euronotian, comprising Tasmania and the south-eastern third of Australia; (3) the Maorian, embracing New Zealand and the adjacent islands; (4) the West Australian. The Caroline, Marshall, and Marianne groups are provisionally included in the Austro-Malay region, while the Hawaiian Archipelago is regarded as an unattached region of great antiquity. Fiji, on the other hand, is considered to be related as regards its fauna to the Papuan Archipelago or to the tropical forest district of eastern Australia, and a Polynesian region is accordingly not admitted; Celebes being regarded as representing an unattached or intermediate region.

Apart from the tropical forest district of Queensland, Australia is characterised by the poverty of its terrestrial molluscan fauna, a feature due, no doubt, to the general dryness of this area. This is remarkably exemplified by the scarcity of members of the group with operculated shells, which is, on the other hand, strongly represented in Queensland and New Guinea. Although slugs of the typical genus *Limax* have been introduced into the country, none is indigenous. A marked negative feature common to the whole of Australia, Tasmania, and New Zealand is the complete absence of the large marsh-dwelling gastropods of the genus *Ampullaria* and of the pond-mussels of the genus *Anodonta*; a few species of *Unio* are, however, to be found in the rivers.

It has been observed that the country as a whole is poor in butterflies, thereby presenting a striking contrast to tropical America, although the coast districts of Queensland are better off in this respect, possessing some handsome species of green *Ornithoptera* and other Malay types. Beetles are more abundant throughout such parts of the country as are suited to their existence; and it is specially rich in the longicorn group.

In common with those of South America and Madagascar, but unlike those of Ethiopian Africa, the rivers of Australia and Tasmania are inhabited by crayfishes belonging to the exclusively southern family *Parastacidæ*; the Australian genera being *Astacopsis* and *Eugæus*. A Tasmanian species of the former, *A. franklini*, which is found in quite small streams, is the largest crayfish in the world, attaining in some instances a weight of eight or nine pounds, and thus rivalling that of the lobster. The distribution of this group of crustaceans is singularly like that of the side-necked tortoises and the boa group of snakes; and, in this case at any rate, affords strong support to the theory of a former land-connection between Australia and Madagascar on the one hand and South America on the other.

LONG-BEAKED ECHIDNA.

CHAPTER II

THE ANIMALS OF NEW GUINEA

THE Papuan province of the Australasian realm comprises the great island of New Guinea, or Papua, together with the Aru Islands, the Moluccas, the Bismarck Archipelago, the Solomon group, and a number of other small islands situated for the most part in the area known as Melanesia. As might be expected from their geographical position, the fauna of Papua and the associated islands is to a considerable degree intermediate between that of Australia and south-western Asia, including as it does a larger proportion of placental mammals, some of which are of types unknown in Australia. The evidence of some of these must, however, be received with caution, as a certain number of them have almost certainly been introduced by man. On the other hand, the distinctness of the Papuan fauna from that of the whole of the rest of the world other than Australia is sufficiently manifested by the presence of egg-laying mammals, marsupials, and cassowaries; its nearest affinity being, as mentioned in the last chapter, with the fauna of the tropical coast districts of northern Queensland. In discussing the Papuan fauna some repetition of the facts mentioned in the preceding chaper is almost unavoidable.

The collections made during the last few years have enormously increased our knowledge of the natural history of New Guinea, more especially in the case of its mammals. In the year 1876, for instance, only nineteen species of Papuan mammals were recognised—exclusive of bats; these being referred to eleven genera—two of which were then believed to occur only on the Aru Islands, and to be unknown on the mainland. One of these Aru types was the mosaic-tailed rat for which the genus *Uromys* was founded, and as this species was believed to be common to

Celebes, it was suggested that it might have been carried from that island to the Aru group. After giving this list of seventeen truly Papuan and two Aru species, Dr. A. R. Wallace remarked that we have here no sign of any approach to the mammalian fauna of the Oriental region, for though pigs have appeared, rats and mice seem to be wanting. At the present day the number of species of Papuan mammals other than bats considerably exceeds a hundred, these being referable to about twenty-eight generic types, of which eleven are referable to the rodent family *Muridæ* (rats and mice). Advanced naturalists would doubtless still further augment the number of rodent genera, for, as already mentioned, it has been proposed to split up the Australasian rats usually included in the typical *Mus* into several distinct generic groups. Following, however, the general arrangement, it is noteworthy that, apart from *Mus*, all the Papuan genera of rats, except *Uromys*, which extends to Celebes, are peculiar to the Australasian region. Nor is this all, for seven of the genera are exclusively confined to Papua, while the prehensile-tailed rats of an eighth genus (*Pogonomys*) are restricted to Papua and the islands of the D'Entrecasteaux group. It is, therefore, clear that in place of having none at all, New Guinea has a rodent-fauna fully as distinct and peculiar as its marsupials and monotremes. Indeed, this scarcely expresses the true state of the case adequately, for the number of peculiar Papuan generic types of rats is considerably larger than that of marsupials and monotremes. That the ancestral Papuan rats reached their present home by way of a land-connection with Asia through the Malay area is practically certain; and this being so, it seems at first sight probable that marsupials followed the same route; though this may have been the case, the subject opens up complicated questions which it would take too long to discuss. Very noticeable is the complete absence of Insectivora (shrews, tupais, gymnuras, and hedgehogs) from the Papuan fauna; but this may perhaps be accounted for by assuming the connection between Malaya and Papua to have been interrupted and not long continued, and that rodents were better fitted than insectivores to cross the obstacles, or to traverse speedily the narrow bridge. As mentioned below, the two species of swine included in the list of Papuan mammals were probably introduced by human agency from Malaya. Eliminating these, it will be found that the mammalian fauna of Papua consists solely of bats, rats, marsupials, and monotremes. The list includes rather more than forty species of bats. If we add this to the list of other groups—minus the two pigs—the indigenous mammalian fauna of Papua at present known to science comprises about one hundred and fifty species.

Native Races.

Papuasians, or Oceanic Negroes, as they are termed by anthropologists, include the Papuans of New Guinea and the Melanesians who constitute the majority of the inhabitants of the islands of the western Pacific, such as New Ireland, New Britain, the Solomons, the Louisiades, the New Hebrides, New Caledonia, and Fiji, and form a separate branch of the Negro stock. Their chief physical distinction from African Negroes lies in the fact that in the skulls of the men the ridges above the eye-sockets are generally well developed, instead of this region being nearly flat. Usually also the nose is narrower and more prominent, especially in New Guinea and the neighbouring islands, and the skull itself is in most cases higher and narrower, although some skulls are essentially of the African type. The hair on the scalp grows in tufts, is very luxuriant.

and stands out widely from the head, this being aided by combing, and thus giving rise to the designation of "Mop-Heads." The beard is more strongly developed than in African Negroes, and the body is more hairy; the colour of the skin being nearly black among the natives of New Caledonia, chocolate-brown in the Papuans of New Guinea, and blue-black in the Fijians.

Bats. In the fruit-eating group the tube-nosed bats of the genus *Nyctimene*, or *Harpyia*, which, as mentioned in the preceding chapter, are represented in the tropical forest-belt of northern Queensland and extend as far west as Celebes, are essentially a Papuan type, four species, *N. papuanus*, *N. cyclotis*, *N. geminus*, and *N. aëllo*, being known from New Guinea itself. Two bats from the Solomons, namely, *Pteralopex atrata* of Guadalcanar Island on the eastern side of the group and *Pt. anceps* of Bougainville Island on the west, alone constitute a genus characterised by the margins of the molar teeth being elevated into distinct cusps.

An allied genus with a large number of species ranging all over the Austro-Malay area is represented in New Guinea by *Dobsonia minor* and *D. magna*, and by other kinds in the Melanesian islands. To another section of fruit-bats belongs *Nesonycteris woodfordi* of the Solomon group, the sole member of its genus, and noticeable on account of its peculiar colouring, the fur being bright orange and the membranes of the wings brown. Allied to *Nesonycteris*, but distinguished from all other fruit-bats by the greater length of the tail, are the two species of *Notopteris*, of which *N. macdonaldi* inhabits the New Hebrides and Fiji, and *N. neocaledonica* New Caledonia. Among the insect-eating bats of the horseshoe family, *Rhinolophidæ*, the curious flower-nosed bat (*Anthops ornatus*) is remarkable for the extraordinary development of the nose-leaf, which extends from eye to eye and from the upper lip to the forehead, where it is surmounted by three small balls, recalling those on an earl's coronet. The numerous other insectivorous bats belong for the most part to widely ranging genera, such as *Rhinolophus*, *Hipposiderus*, *Pipistrellus*, *Cerivoula*, *Emballonura*, and *Taphozous*.

Rodents. Gnawing mammals are represented in New Guinea by various kinds of mice and rats (*Muridæ*), among which a few may have been introduced. In the first group are included two species, *Hydromys beccarii*, and *H. esox*, belonging to the same genus as the Australian yellow-bellied water-rat, to which reference has been made in the preceding chapter. To the same group belongs Monckton's water-rat (*Crossomys moncktoni*), of British New Guinea, which is about the size of an ordinary water-rat, and blackish grey above and white beneath. It is more thoroughly specialised than *Hydromys* for an aquatic existence, being in this respect likewise considerably in advance of the European water-rat. This is indicated by the woolly character of the close, soft fur, the twisted hind-feet, which are broad and paddle-like, the absence of external ears, and the fringed tail, closely resembling that of the water-shrew. In possessing all these features together, the black and white New Guinea water-rat is ahead of all other rodents, for although the American musquash has a still more specialised type of tail and similar fur and feet, it retains well-developed external ears. In general appearance this rodent presents a striking superficial resemblance to the Russian desman, a member of the insectivorous order. *Parahydromys*, or

Limnomys, asper is another New Guinea murine representing a genus by itself, and belonging to the same exclusively Australasian section. The same is likewise the case with the three New Guinea rats respectively known as *Hyomys meeki, Mallomys rothschildi,* and *Anisomys imitator*; the last of these being a large species easily recognised by the peculiar structure of its incisor teeth, which are quite unlike those of any other rat.

Among more typical New Guinea *Muridæ* are several species generally included in the cosmopolitan genus *Mus,* together with about a dozen referable to the mosaic-tailed Austro-Malay *Uromys,* while another dozen or so, some of which are natives of the smaller islands, represent the distinctively Papuan genus *Pogonomys,* which, although nearly related to the mosaic-tailed rats, has the scales on the tail overlapping. Forbes's rat, of the mountains of New Guinea, which had been made the type of a distinct genus, *Chiruromys,* is now included in *Pogonomys,* under the name of *P. forbesi.* Yet another peculiar genus of New Guinea mice has been described as *Lorentzimys nouhuysii*; it is a small jumping species, characterised by its very long and slender tail, large hind-feet, and large, pointed ears.

Deer. Although no deer are found in New Guinea itself, a few species are met in some of the smaller islands of the Papuan province, at least some of which appear to have been introduced. The island of Timor, for instance, which is included in the Malay province, is inhabited by a local race (*Cervus,* or *Rusa, hippelaphus timoriensis*) of the Javanese rusa deer, and a second race (*C. h. moluccensis*) is found in the Moluccas. The first of these, it is suspected, may have been introduced by the Malays, and it is quite probable that the same may hold good in the case of the second. According to a recent writer (Dr. L. F. de Beaufort), the Moluccan rusa was introduced from Ceram into the Aru Islands by Governor Cleerens about the year 1855. The skins of two young deer recently received from the Aru Islands, which are probably the descendants of the specimens introduced from Ceram, were examined by the naturalist just mentioned. To a certain extent the fact that the deer in the Aru Islands have been introduced supports the view that those of the Moluccas and Celebes are not indigenous.

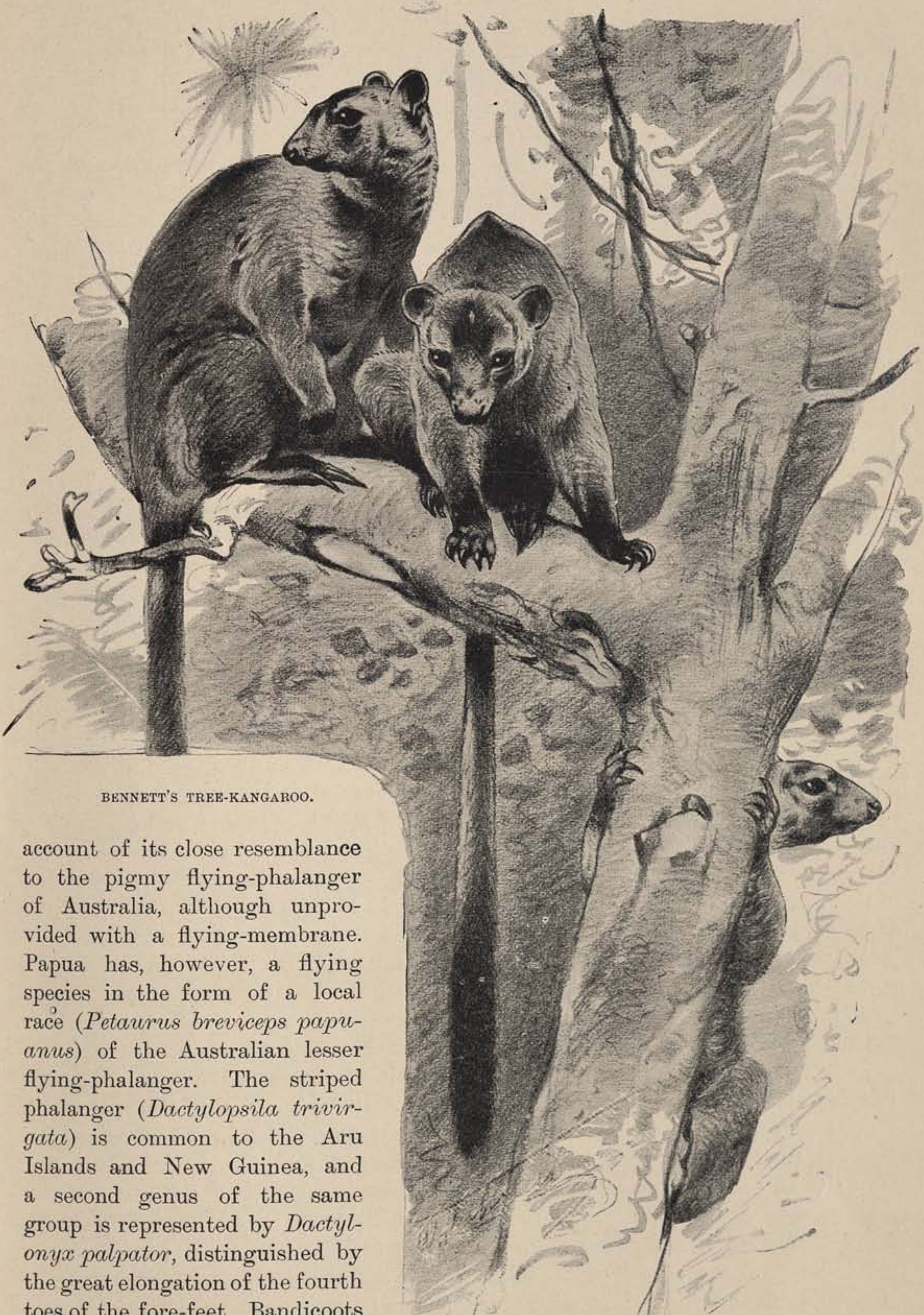
Wild Pigs. Wild pigs, which have been referred to two species, *Sus niger* and *S. papuensis,* are common in New Guinea and many of the smaller Papuan and Melanesian islands, but it has long been a disputed point whether these pigs of New Guinea, the Bismarck Archipelago, and the Caroline Islands are indigenous, or have been introduced by human agency. The question is of some importance, for upon the answer depends in some degree the line of division between the Oriental region and the Australasian realm. A German naturalist, Mr. Max Bauschke, after pointing out that these swine are specifically distinct from ordinary European pigs, and more nearly related to Oriental species, states that there is good reason for the belief that during the Miocene or middle portion of the Tertiary epoch the islands of the Malay Archipelago were more or less completely connected with one another and with the Asiatic mainland. During this connection the Malay species known as *S. vittatus* made its entrance into Java, but proceeded no farther east; its place in Borneo, Celebes, the Philippines, and the northern Moluccas being taken by the distinct *S. verrucosus.* From this it follows that if truly wild swine are found in New Guinea, they must be of the *verrucosus* type, whereas they belong to the *vittatus* group. Hence it seems indisputable that the Papuan wild swine are the descendants of tamed representatives of the latter introduced by man; the length of time they have been in their present home being sufficient for them to have acquired distinctive peculiarities of their own. And from the migrations of natives, which appear to have taken place at an early period, it seems probable that in New Guinea the introduction of the ancestors of the wild swine was previous to the arrival of Europeans in these islands, but that in the Moluccas, Bismarck, and Caroline Islands the introduction was made by Europeans during the eighteenth century.

These conclusions are strengthened by the fact that whereas the wild swine of New Guinea differ to a certain degree in external characters from the typical *S. vittatus*, those of the Bismarck Archipelago and the Caroline Islands are practically indistinguishable from the latter. In the Marianne Islands *S. vittatus* occurs partially in a domesticated and partially in a half-wild condition, but there are also swine which appear to be a cross between that species and the European swine (*S. scrofa*), these being probably the product of interbreeding between a domesticated Italian breed and the *S. vittatus* stock introduced at an earlier period.

Marsupials.

Among the Papuan marsupials is the Aru Island wallaby (*Macropus brunii*), the first member of the kangaroo tribe known to Europeans, a specimen having been brought to Batavia so early as 1711. The agile wallaby (*M. agilis*) is common to Australia and New Guinea; but the great feature of the latter island, so far as the kangaroo tribe is concerned, is the presence of one peculiar genus and the number of species of tree-kangaroos. The solely Papuan genus includes the dorca-kangaroos, which stand to a great extent midway between the more typical members of the family and the tree-kangaroos, the disproportion in length between the front and hind limbs being much less marked than in the former group. The typical species is the brown dorca (*Dorcopsis muelleri*), which recalls the Aru Island wallaby in general appearance, but, like the other dorcas, is distinguished by the forward direction of the hair on the back of the neck, as well as by the large, broad, bare muzzle and the small ears. Of the tree-kangaroos, the black *Dendrolagus ursinus* inhabits north-western New Guinea, and is blackish above and puce-brown below; the so-called brown tree-kangaroo (*D. inustus*), on the other hand, is grizzled grey; while Doria's tree-kangaroo (*D. dorianus*), of the south-eastern districts, is dark brown, and further distinguished by the forward direction of the hair of the back. Other notable species are Bennett's tree-kangaroo, *D. bennetti*, and *D. aurantiaca*, which show a considerable amount of yellow in their colouring, more especially on the tail.

In the phalanger group the spotted cuscus (*Phalanger maculatus*) referred to in the preceding chapter, is common to Australia and Papua, a second species, the grey cuscus (*P. orientalis*), inhabiting Timor and some of the neighbouring islands; and there are several others from New Guinea. The ring-tailed phalangers of the genus *Pseudochirus*, which are represented in northern Queensland, have numerous Papuan species belonging to the group without a white tip to the tail. The Australian dormouse-phalangers have a Papuan representative in the long-tailed *Dromicia caudata*; and the tiny pen-tailed phalanger (*Distœchurus pennatus*) is a purely Papuan type, remarkable on

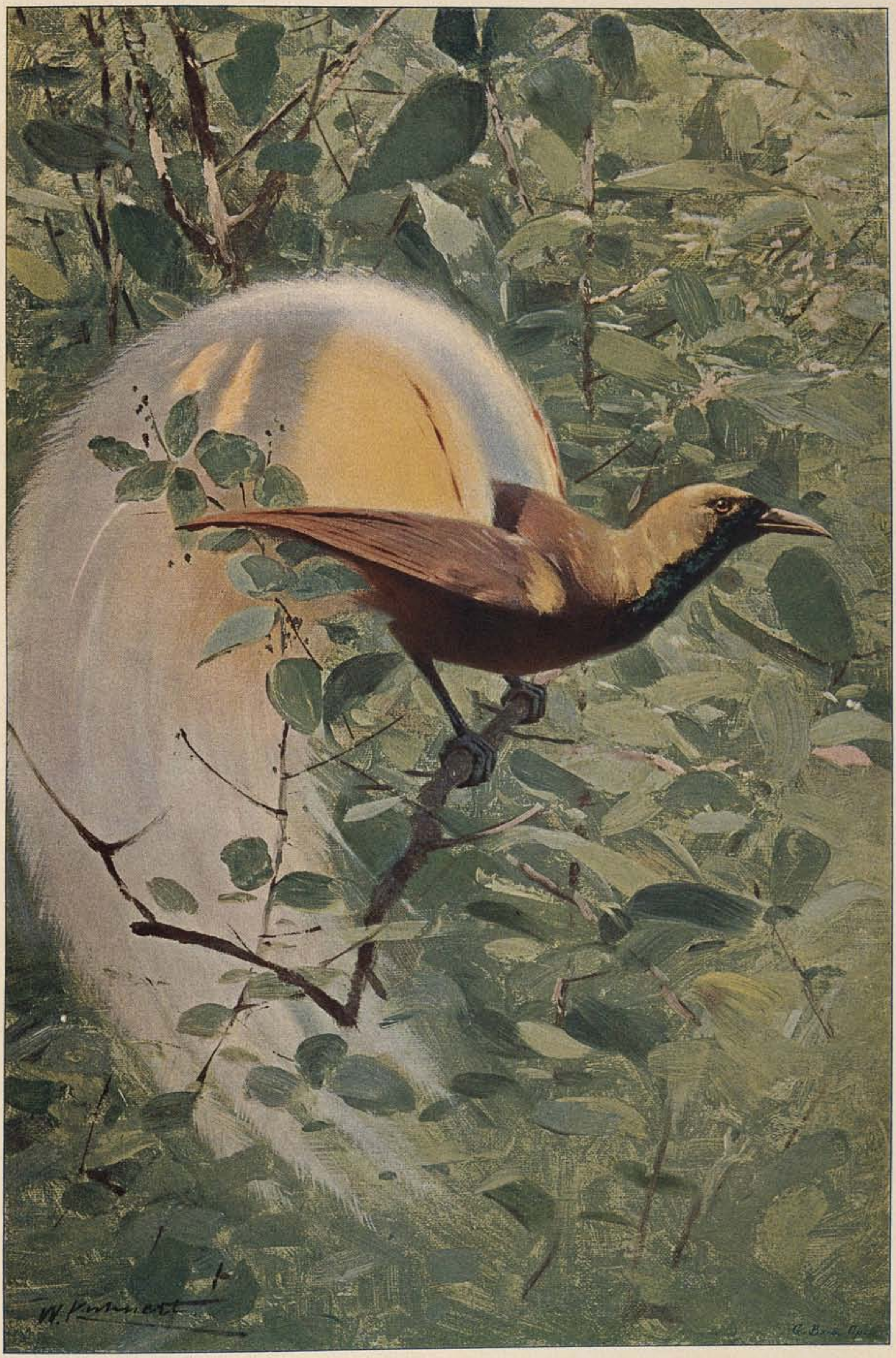


BENNETT'S TREE-KANGAROO.

account of its close resemblance to the pigmy flying-phalanger of Australia, although unprovided with a flying-membrane. Papua has, however, a flying species in the form of a local race (*Petaurus breviceps papuanus*) of the Australian lesser flying-phalanger. The striped phalanger (*Dactylopsila trivirgata*) is common to the Aru Islands and New Guinea, and a second genus of the same group is represented by *Dactylonyx palpator*, distinguished by the great elongation of the fourth toes of the fore-feet. Bandicoots abound in the Papuan area, *Perameles moresbyensis*, *P. broadbenti*, *P. raffrayana*, and *P. cockerelli*, with at least three others, being from New Guinea, although the range of the last-named includes New Britain. Some writers divide bandicoots into several genera, and a small species from Dutch New Guinea has been described as *Suillomeles hispida*. The Australian native cats, or dasyures, have two Papuan representatives in the New Guinea *Dasyurus albopunctatus* and *D. dæmonellus*, and there are several pouched mice, such as *Phascologale melas*, and five or six other species from New Guinea.

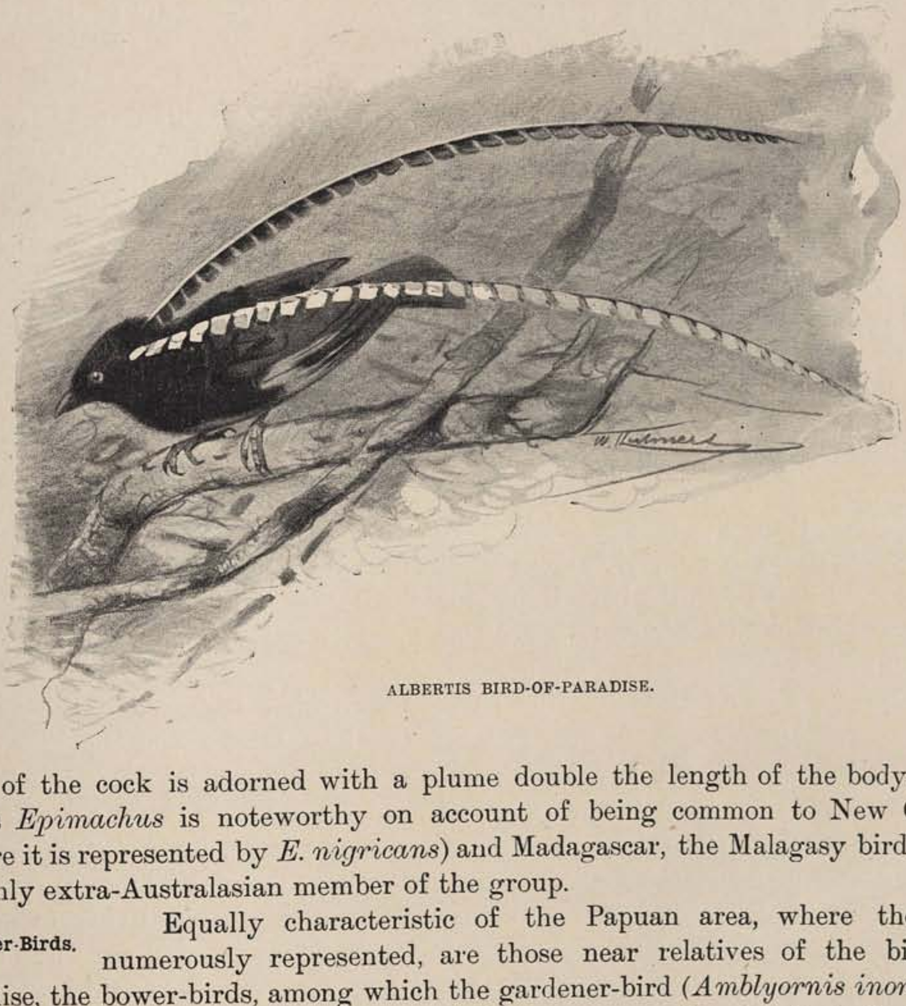
Spiny Anteaters. Although the platypus is unknown, spiny anteaters are more strongly represented in New Guinea than Australia, for in addition to the Port Moresby race of the Australian species (*Echidna*, or *Tachylossus*, *aculeata lawesi*) an entirely different type is represented by *Proëchidna*, or *Zaglossus*, *bruijni*, and by allied races or species (*P. bartoni* and *P. nigro-aculeata*). These differ from the typical genus by the greater length and the marked downward curvature of the beak, as well as by having only four front-claws, instead of five. A living specimen of one of these long-beaked echidnas recently exhibited at Amsterdam showed that the pose of the body and limbs is quite different to the one given in pictures and mounted specimens. In these the animal is represented with the belly resting on the ground, and the claws of the hind-legs extended backwards like those of a lizard. In reality, it stands up on its legs in elephant-fashion, with the hind-claws directed outwards and slightly forwards, this being a remarkable attitude for a burrowing animal. Unlike the ordinary echidna, which refuses to touch them, the long-beaked species exhibit a marked partiality to earth-worms.

Birds-of-Paradise. Despite a general resemblance between the birds of the Papuan province and those of the Austro-Malay islands, yet there are a number of types peculiar to the former area, which may be regarded as the real home of the birds-of-paradise (*Paradiseidæ*). As mentioned in the preceding chapter, this group of gorgeously coloured and eccentrically decorated birds is specially characterised by the development in the males of ornamental plumes of varied and bizarre types on different parts of the body, as well as by the generally velvety character and shortness of the feathers on the neck. All the members of this gorgeous group of birds display a strangely restless disposition; they keep, as a rule, to the tops of tall forest trees, and the females lay two eggs in a clutch, which in their marking recall those of the rail group. The typical birds-of-paradise, or those included in the genus *Paradisea*, are characterised by their short and slightly curved crow-like beak. Among the numerous Papuan species, the manukodia (*P. chalybea*) of north-western New Guinea is about the size of a jackdaw, and specially distinguished by the curling feathers of the head and neck. In colour it is mainly black but the plumage of the head and neck displays an exquisite green gloss, the feathers of the body being violet in colour and less glossy. The typical or great bird-of-paradise (*P. apoda*) of the Aru Islands is not only the largest member of the whole family, but surpasses all the rest in the magnificence of the plumage of the cocks, which is too well known to need description, even if adequate description were possible. The lesser paradise-bird (*P. minor*) of the island of Mysol is somewhat smaller, but otherwise very similar, as is also the red *P. sanguinea*, a small species restricted to the small



GREAT BIRD OF PARADISE.

islands of Waigiou, Batanta, and Ghemien, specially distinguished by the deep carmine plumes on the flanks of the cocks. Another type is represented solely by the king bird-of-paradise (*Cicinnurus regius*), of New Guinea, easily recognised by the two spatula-shaped spiral tail-feathers, with plumes at the tips, of the males. The six-plumed bird-of-paradise (*Parotia sexpennis*), also a native of the same great island, has two triple plumes of spatula-shaped feathers on the back of the head of the cock; the standard-winged species (*Semioptera wallacei*) takes its name from the pair of long white feathers at the bend of each wing, and is further characterised by the pair of long green plumes on the breast. Perhaps, however, the most wonderful member of this wonderful tribe is the Albertis bird-of-paradise (*Drepanornis albertisi*), in which each side of the neck of the cock is adorned with a plume double the length of the body. The genus *Epimachus* is noteworthy on account of being common to New Guinea (where it is represented by *E. nigricans*) and Madagascar, the Malagasy bird being the only extra-Australasian member of the group.



ALBERTIS BIRD-OF-PARADISE.

Bower-Birds. Equally characteristic of the Papuan area, where they are numerously represented, are those near relatives of the birds-of-paradise, the bower-birds, among which the gardener-bird (*Amblyornis inornatus*) of New Guinea constructs a moss-covered bower generally placed at the foot of some large tree, and about two feet in height. This structure, which is built of orchid-stems, is surrounded by a gallery, and supported by a pillar; the whole having a conical form. In front of the entrance is a small garden, or play-place, carpeted with moss, and ornamented with berries and flowers, which are renewed directly they show signs of withering. *A. inornatus* and *A. subalaris* are respectively olive and reddish brown birds with an enormous orange crest on the head; while in *A. flavifrons* the orange of the crest is replaced by yellow. There are, however, much more brilliant species, such as *Prionidura newtoniana* of Queensland, referred to in the preceding chapter, which is bright orange, olive, and brown, and *Cnemophilus macgregori* of New Guinea, in which golden yellow above contrasts with velvety black beneath, while the wings and tail are brownish, and a thin curved crest merges into a ridge on the forehead with chestnut feathers extending to the base of the beak.

Kingfishers. Among many Papuan kingfishers it must suffice to mention the exclusively Australasian racket-tailed group, of which the beautiful *Tanysiptera galatea* is a well-known native of New Guinea. All these birds take their name from the great development of one pair of tail-feathers, which are of great length with narrow vanes and expanded racket-like tips In the species mentioned the crown of the head and the bend of the wings together with the greater portion of the elongated middle tail-feathers, are bright blue; while the shoulders, the remainder of the wings, and a broad band across the sides of the head are indigo blue. In striking contrast to this is the white of the hind portion of the back and under-parts, the terminal rackets of the middle tail-feathers, and the greater portion of the rest of the tail in which the outer feathers have narrow blue margins. A coral-red beak completes the gorgeous colouring of this lovely kingfisher. More distinctive of New Guinea is the wide-mouthed kingfisher (*Clytoceyx rex*), the only member of a genus, characterised by the thick, blunt, and rather short beak. In colour this bird is brown on the upper-parts, with a rufous collar, blackish back and neck stripes, light blue rump, and greenish wing and tail quills, while the under-parts are light chestnut, with the throat white.

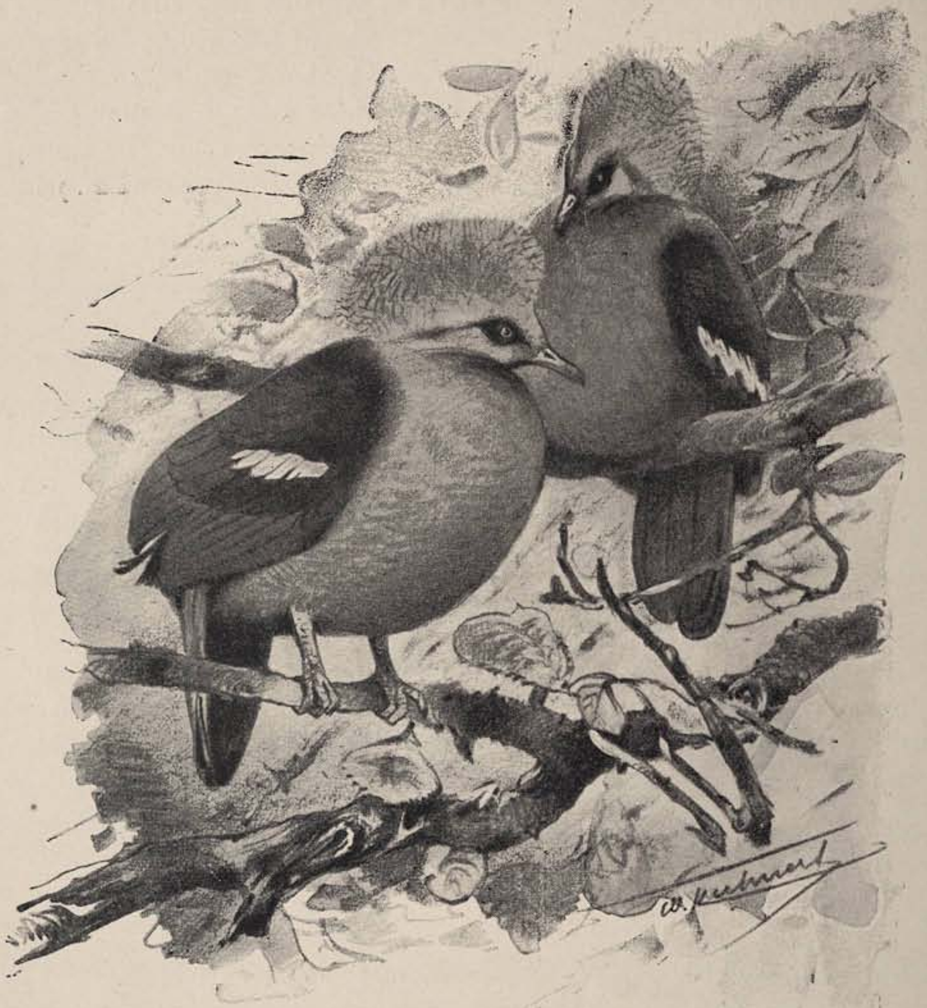
Hornbill. Of the widely spread rhinoceros-hornbills there is one New Guinea species, *Buceros plicatus*, which takes its specific name from the grooves running obliquely across the beak. With the exception of the ochre-yellow head and neck, the bare light blue throat and cheeks, and the white tail this fine bird has the plumage glossy black. It inhabits several of the smaller Papuan islands as well as the mainland.

Parrots and Cockatoos. In members of the parrot group New Guinea is fully as rich as Australia; and the Papuan province is the sole habitat of the beautiful eclectus parrots, the females of many of the species of which literally blaze with scarlet and crimson, whereas the males are green. The range of the genus extends from the Moluccas, where it is represented by *Eclectus irroratus*, to the Solomon Islands, a well-known New Guinea species being *E. pectoralis.* These birds are somewhat lazy and unsociable in disposition, living in pairs in large forests, and feeding chiefly on seeds, although also eating fruit and insects. Pesquet's parrot (*Dasyptilus pesqueti*) is a peculiar Papuan type, in which the plumage is for the most part black, with the tail-coverts, under-parts, much of the wings, and a band on each side of the back of the head, red. The large-beaked parrots of the genus *Tanygnathus* form another practically Papuan group, with a few outlying species in Celebes and the Philippines. The lories again, especially the broad-tailed species of the genus *Domicella*, are chiefly characteristic of the Papuan area. As is well exemplified by the brilliant *Lorius ruber* of the

Moluccas, the plumage of these birds is mainly red. Most of the pigmy parrots, of which the largest is about equal to a bullfinch in size, while the smallest is no bigger than a wren, are likewise natives of New Guinea and the neighbouring islands, although a few occur in northern Australia and the Philippines. In *Nasiterna pygmæa* the length is only 3 inches, and it is but little more in the red-capped *N. bruijni*. These pretty little birds are frequently called woodpecker-parrots from the nature of their habits and the circumstance that the tips of the tail-feathers extend like spines beyond the ends of the vanes. These parrots climb like woodpeckers, and frequent certain fig-trees, which in New Guinea produce their inflorescence on the stems. From these buds they suck honey; and while thus engaged support themselves by the tips of their tail-feathers like woodpeckers, thereby rapidly wearing them out. The red-breasted *N. pygmæa* is green above, with blackish edges to the feathers, the under-parts are light red, the crown is yellowish with red-edged feathers on the forehead, while the middle tail-feathers are blue, and the remainder black with yellow tips and green outer edges. In addition to containing the smallest parrots of the Australasian region, Papua is the home of one of the largest members of the group. This is the great black cockatoo (*Microglossus aterrimus*), a bird indigenous to New Guinea and the neighbouring islands, as well as to the north-east of Australia. In colour these cockatoos are deep black, with naked red cheeks. They have large and powerful compressed beaks, with which they are able to crack the hard kanary-nuts, on which they subsist, whose kernels cannot be reached by any other birds.

PESQUET'S PARROT.

Game-Birds and Pigeons. As the megapodes, or brush-turkeys, which are spread all over the Papuan province, have been alluded to at some length in the preceding chapter, it will suffice to mention Freycinet's megapode (*Megapodius* *freycineti*) as a well-known Moluccan species. Among the pigeon tribe the so-called pheasant-doves, of which *Otidiphaps nobilis* is a typical example, take their name from the somewhat pheasant-like appearance produced by their chestnut-coloured backs and wings. The members of this genus, which are characterised by the possession of twenty tail-feathers, are common to New Guinea and Fergusson Island. Far more striking birds are the beautiful blue crowned pigeons, the largest of all the Columbæ, which are represented by some half-dozen species ranging over Papua and the neighbouring islands. As well-known members of this fine group mention may be made of the Victorian crowned pigeon (*Goura victoria*), of Jobi and Mysori, of *G. beccarii* of central and northern New Guinea, and of *G. coronata* of western New Guinea, Waigiou, and several of the other islands. The last-named species, which was discovered in 1699, is bluish slate-coloured, with darker wings, some black on the chin and the sides of the head.



WESTERN CROWNED PIGEON.

chestnut band on the back, another of white on the wing, and grey tips to the tail-feathers. These pigeons associate in flocks, and range from the plains to an elevation of about one thousand feet.

Cassowaries. As mentioned in the preceding chapter, cassowaries are mainly characteristic of the Papuan region, Australia possessing but one species, *Casuarius australis*, and that confined to the north-eastern districts, where, as already mentioned, the fauna is of a Papuan type. The large bodily size, horny helmet, gorgeously coloured head and neck, and hair-like black plumage render these giant flightless birds distinguishable at a glance from all their kindred. The brilliant blue, green, orange, and crimson of the naked parts of the head and neck, which contrasts so strongly with the sable plumage of the chest and neck, makes them peculiarly striking birds. The eight species arrange themselves in three easily recognisable groups. Of the first group the most familiar representative is the common cassowary of Ceram, *Casuarius galeatus*. In this group the helmet is very tall and compressed, ending in an elevation posteriorly, while there are two naked wattles on the throat. On the other hand, in the second group, as typified by the single-wattled *C. uniappendiculatus*, the helmet which may be laterally compressed, has its hind end abruptly truncated, and at the same time there is but a single throat-wattle. In the third group, long known only by the moruk (*C. bennetti*) of New Britain, there is the same posterior truncation of the helmet, which is relatively small and low, but the throat-wattles are absent. The species and subspecies of the three groups are distinguished from one another by the size of the helmet, the coloration of the naked parts of the head and neck, and the form and dimensions of the wattles, when these strange appendages are present.

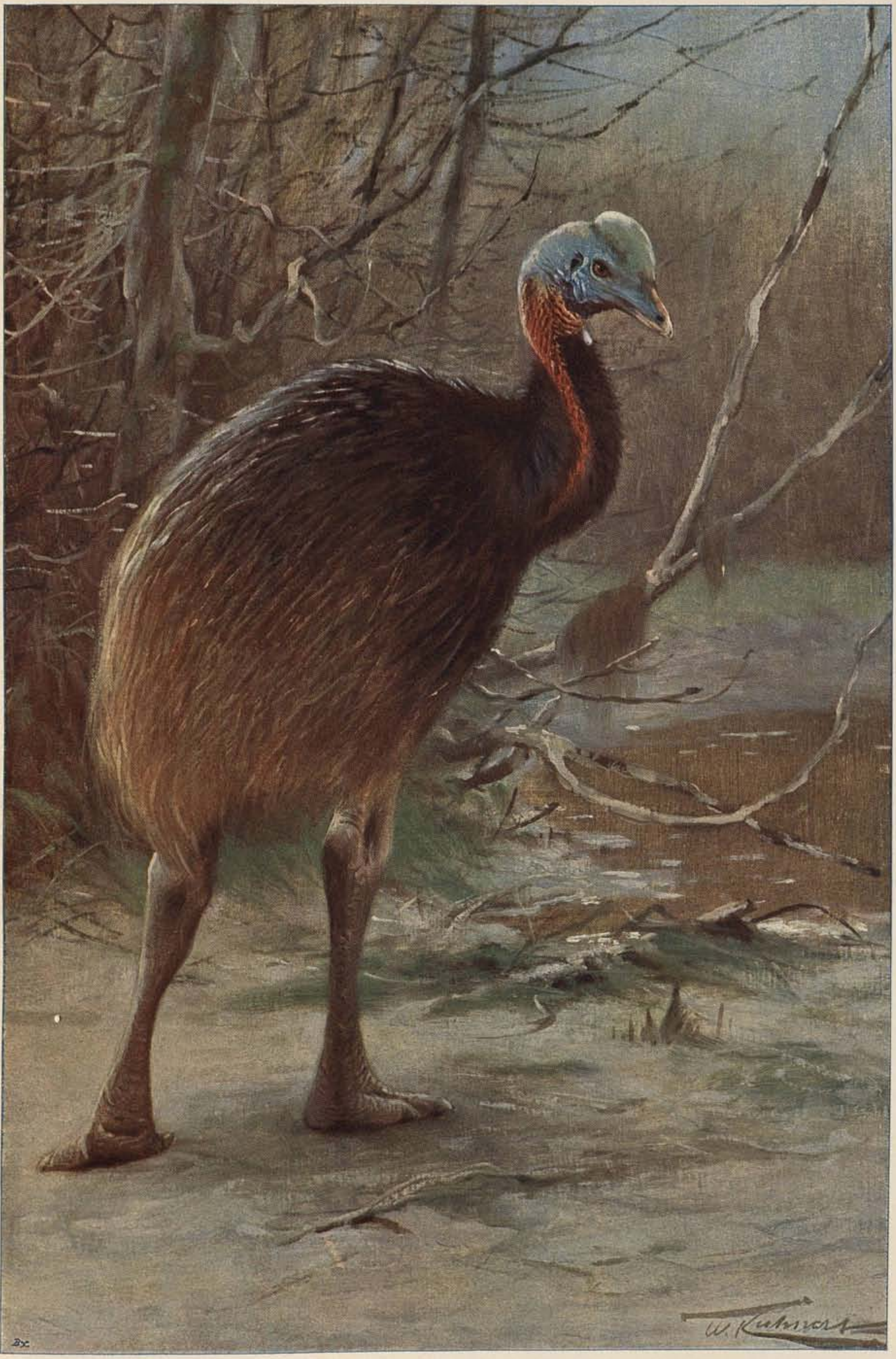
"Cassowary-land" embraces New Guinea and some of the adjacent islets, Salwatti, New Britain, the Aru Islands, northern Queensland, and Ceram in the Moluccas. And it is not a little remarkable that the common species, inclusive of its local varieties, extends from one end of this large distributional area to the other, being found alike in Ceram and Queensland.

As regards their mode of life, cassowaries are inhabitants of forests, while ostriches, rheas, and emeus are denizens of steppes and deserts. Their food consists of all kinds of vegetable matter, including fruits; but they also pick up insects and such creeping creatures as come in their way. In captivity they will kill and devour chicks and small birds. Like ostriches, rheas, and emeus, they swallow quantities of stones and gravel to assist digestion. They are entirely diurnal, sleeping from sunset till morning. The voice of cassowaries is a sort of snorting, grunting, and bellowing, usually not very loud, and differing according to the species. Their temper is generally sullen and treacherous, and they are extremely pugnacious, the two sexes often fighting with one another, except in the breeding-season. As in their kindred, incubation is performed by the cocks alone. The eggs, which are light green in colour when first laid, soon fade to a dirty white. Six to eight have been laid in a clutch in England. The theory that some eggs are laid in the neighbourhood of the nest for the nutriment of the young is regarded by an eminent English naturalist (as in the case of the ostrich) as a mere traveller's tale. The eggs are reported to be excellent food.

The first member of the group discovered by Europeans was the Ceram cassowary, a specimen of which was presented in December 1596 to the captain of the Dutch ship *Amsterdam* when anchored at Sydayo, Java, where the bird had been sent from Banda. Despite the subsequent burning and abandonment of the *Amsterdam*, the wonderful "large fowl" was eventually taken home in another vessel to Holland, where it was exhibited to an admiring public the following year. But it was not till 1726 that the true habitat of the species was made known, although certain Dutchmen are stated to have captured a specimen while on its nest in Ceram so long ago as the year 1660. Although by no means rare, the Ceram cassowary is such a shy and retiring bird that no European appears ever to have beheld it in the wild state. The New Britain moruk, on the other hand, is a species of far less timid disposition, which can be tamed without much difficulty.

Lower Vertebrates. The reptiles, amphibians, and fishes of the Papuan province are in general allied to those of Australia, although in certain instances they display more decided Malay affinities. The most noteworthy reptile is a large fresh-water tortoise, *Carettochelys insculpta*, from the Fly River, New Guinea, probably belonging to the side-necked section, but representing by itself a genus and family of which the affinities are not yet fully known. Lizards of the skink group (*Scincidæ*) are numerous, although they apparently include no generic types restricted to the area; there is, however, the genus *Dibamus*, the sole representative of the allied family *Dibamidæ*, with one species, *D. novæ-guineæ*, in New Guinea, the Moluccas, and Celebes, and a second, *D. nicobaricus*, in the Nicobar Islands. There are certain frogs, *Batrachopsis melanopyga* and *Asterophys turpicola*, representing by themselves generic types restricted to New Guinea. It may be added that the Solomon Islands are the home of a frog, *Rana guppyi*, second only in size to the gigantic Cameruns species referred to in an earlier chapter.

Invertebrates. Some of the features of the land-snail fauna of the Papuan province have been already mentioned in the chapter on the animals of Australia, where special reference is made to the general community of type between the land-molluscs of north-eastern Australia and the province now under consideration. New Guinea itself, like the Aru Islands and several of the islands of Melanesia, is remarkable for the abundance of its snails, although slugs seem to be represented only by a species of *Vaginula*, a genus allied to the agate-snails but representing by itself a distinct family. Of the numerous genera of snails more or less nearly restricted to New Guinea may be mentioned *Papuina* and *Insularia*, the latter of which is entirely confined to Papua proper; other genera, such as *Chlorites* and *Planispira*, are common to New Guinea and the Moluccas, while yet others (*Pedinogyra* and *Hadra*) are shared by the former country and tropical Queensland. Some of the largest and handsomest members of the *Helix* group are found in the teeming forests of New Guinea, where, however, operculated snails are rare, the genus *Cyclophorus* being entirely lacking. Some years ago no less than fifty-two genera of land and fresh-water molluscs (of which *Papuina* was represented by thirty-five species) were known from New Guinea alone, and it may be that the number has been increased since that date. The Aru Islands are closely related in their mollusca as well as in their other faunas to the



SINGLE-WATTLED CASSOWARY.

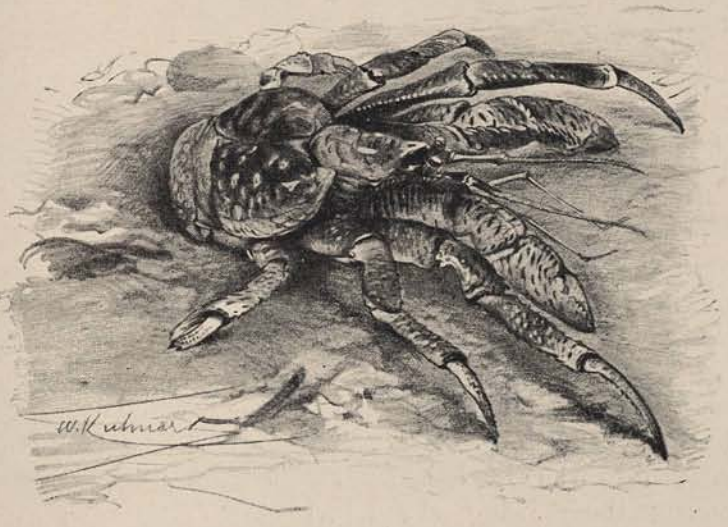
adjacent mainland, but at the same time exhibit distinct evidence of long isolation by the fact that out of thirty-six land-snails no less than fifteen are peculiar. About the same proportion of restricted forms characterises the land-snails of the Solomon Islands, fifty out of one hundred and fifty coming under this category. The great feature of these islands is the extraordinary number of species of *Papuina*, some of which display remarkable eccentricities of form. In habits these snails are mainly arboreal, and they may be met with in profusion on the branches and leaves of trees both in New Guinea and the Solomon Islands.

Among the host of Papuan insects it must suffice to refer to the abundance of the gorgeously coloured butterflies belonging to *Ornithoptera* and certain allied genera, notable not only on account of their large size, but also from the great difference between the males and females of the same species. *Ornithoptera* itself, as now restricted, is largely a Malay type, although some of its members inhabit the Moluccas and the typical Papuan islands, but the species of *Troides* are mainly found in the Papuan area, to which the handsome *T. priamus* and its existing relatives are almost restricted, that particular kind being a native of Amboyna and Ceram. The allied genus *Ætheopteris* is typified by *Æ. victoriæ* of the Solomon Islands, in which the females are considerably larger than their partners; the same being the case with the striking species, *Schoenbergia paradisea* from the Finisterre Mountains of New Guinea, shown in the annexed illustration, which is the sole representative of its genus, and lives at an elevation of about 1500 feet above sea-level. The males, which measure five inches across the wings, have the front pair of wings black, marked by two broad green bands glossed with golden yellow, and a shorter bar of the same colour on the hind margin. The hind-wings are green, more distinctly tinged with golden yellow than the front pair, and narrowly bordered on their outer margins with black, and with a broader band of the same at their bases and on the inner margins. The females, which are considerably larger, are black with a double row of white spots on the front-wings, these decreasing in size and converging as they approach the hind-angle. The second pair of wings display a pale band near the free margin, while the outer portion is yellow, shading into bluish grey and whitish, and traversed by a row of black spots. These splendid butterflies, which belong to the swallow-tail family (*Papilionidæ* or *Equitidæ*), are in the habit of hovering round and about the perfumed white flower of *Cerbera odollam*, a plant related to the oleander. Their caterpillars carry strong spines, and the strange form of the pupa suggests that it developed for the purpose of terrifying birds and other enemies.

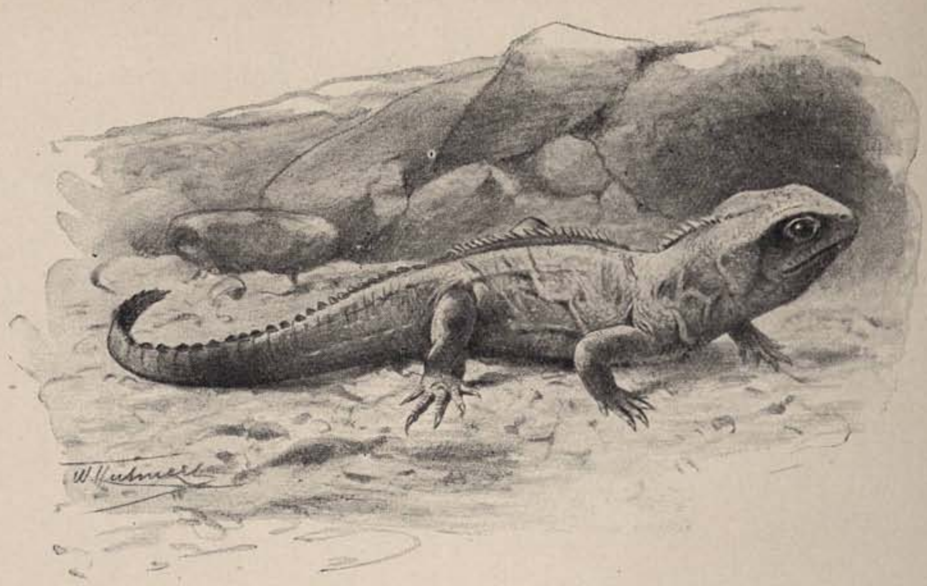
As regards crustaceans, it is probable that the Papuan province possesses crayfish akin to those of Australia. As a common inhabitant of the islands of the province, to which, however, it is in no wise restricted, reference may be conveniently made in this place to the great cocoa-nut crab (*Birgus latro*), which in general appearance recalls a monster hermit-crab. These crabs subsist chiefly on cocoa-nuts, to procure which they often climb the palms, if they cannot find fallen nuts. Although doubts have been expressed in regard to the truth of this statement, it has been found to be authentic by observations on captive specimens at Batavia and examples near Bantam which have been actually seen climbing to the top of mangrove-trees and palms fully 60 feet in height. What they did when at the top was not ascertained, but from the aforesaid captive specimens it was considered probable that they were engaged in opening young cocoa-nuts and devouring their contents. Whether they have the power of opening ripe cocoa-nuts could not be determined, the specimens under observation merely fumbling such as were given them without attempting to penetrate the shell.

SCHOENBERGIA PARADISEA.

The last animal that can be noticed in this brief sketch of the Papuan area is a member of a remarkable group of arthropods (that is to say, jointed animals, such as insects, crustaceans, and spiders) typified by the genus *Peripatus*. These creatures, which look somewhat like slugs furnished with a large number of very short legs, and indeed were at first described as molluscs, are mainly a southern type, and for some years have been known from South Africa, Queensland, South America, and the West Indies, with possibly an outlying representative in Sumatra. Recently a species has been discovered in Dutch New Guinea, and is referred to a separate genus under the name of *Paraperipatus lorentzi*. This species, of which both the male and female are known, is of interest as filling a gap in the distribution of the group. The two original specimens were discovered in moss on Mount Wichmann, at a height of between 9000 and 10,000 feet. In colour the species is dark greenish blue, becoming somewhat paler on the under side, and with a median central row of small whitish spots. These curious arthropods, which evidently represent a very primitive type, require a warm, damp climate, are averse to light, and very sluggish in their habits. Their distribution serves to support the theory of a former land connection between the southern continents.



COCOA-NUT CRAB.



THE TUATERA.

CHAPTER III

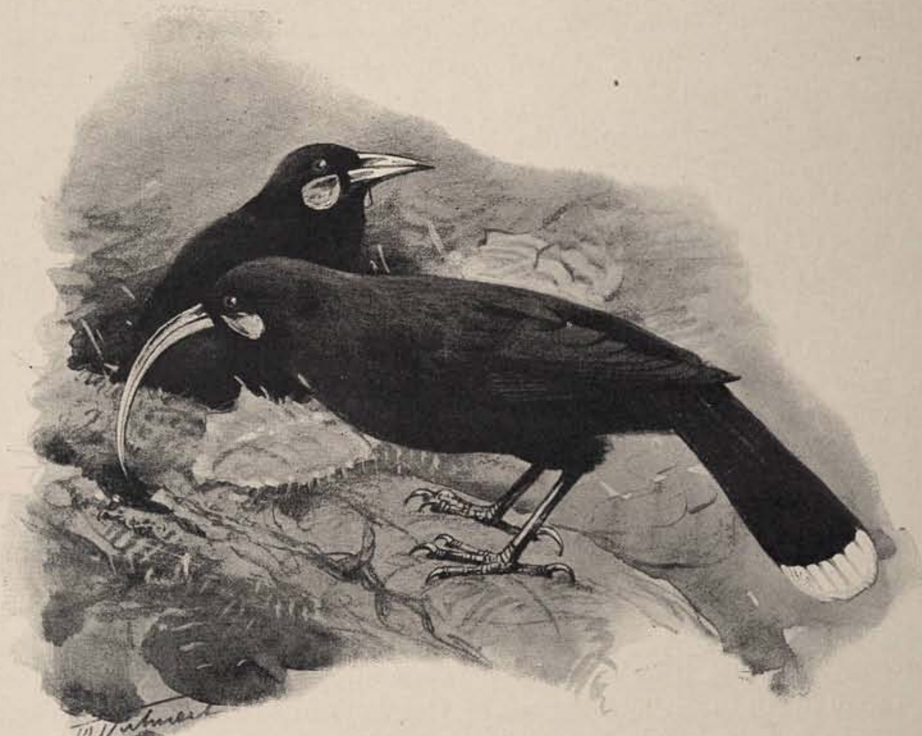
The Animals of New Zealand

Of the outlying islands of the Australasian realm by far the largest is New Zealand, which, it need scarcely be mentioned, really comprises two distinct main islands, the North and the South; these, on account of their relative geographical positions, displaying great local variation in climate, the North Island being, of course, the warmer of the two. For the most part New Zealand possesses a luxuriant vegetation, including great masses of tree and other ferns, which impart a characteristic appearance to the landscape. Forest-trees likewise attain a great development, among these being the kauri pine (*Dammara australis*), the kahikatea pine (*Podocarpus dacrydioides*), and the so-called black-bush (*Notofagus fusca*). The delicate nikau palm (*Arecasa pida*), the only member of its tribe indigenous to these islands, and the numerous stately tree-ferns impart a tropical character to the vegetation of the warmer districts where they flourish. In the woods of the cooler districts shrubs and bushes replace the profusion and luxuriance of the warmer areas. On the eastern side of the central backbone of mountains are desert plains, the tall forest not making its appearance till an altitude of from about 2000 to 3000 feet is attained. In these forests, with the exception of an abundant growth of saplings of the black-bush or southern beech, there is little undergrowth. In the more exposed districts stony plains covered with thorny shrubs and grass are common. On these also grow certain peculiar types of umbelliferous plants, which flourish only on dry soils, where they form conical masses of sword-shaped leaves; numerous other flowering plants being also characteristic of these drier districts.

The Maoris. The original native inhabitants of New Zealand, known as Maoris, form a tribe of the Polynesian stock, referred to in the next chapter, but their physical peculiarities are so marked that they form a well-defined branch. Their distinctive characteristics have been regarded as due to a mixture of Polynesians and Melanesians, the result of this fusion being supposed to have resulted in a Caucasian type. But if Polynesians are rightly regarded as Caucasians, these features require no explanation. According to their own traditions, the Maoris reached New Zealand from an island called Hawaiki, but they really came from Rarotonga, and it seems that the immigration took place not more than four centuries ago. It has been suggested that such traces of Melanesian blood as the Maoris appear to retain may be due to mixture with a small population of Melanesians inhabiting New Zealand before the arrival of the strangers, but whether there was really a Melanesian population in those islands before the Maori immigration is still an undecided question.

Bats. Two marked peculiarities, the one positive and the other negative, are highly characteristic of the vertebrate fauna of New Zealand, namely, the abundance of species of flightless birds—some of the extinct members of which were of gigantic stature—pertaining to several perfectly distinct groups, and the absence of all mammals with the exception of two peculiar species of bats and the so-called Maori rat, which has almost certainly been introduced by the race from which it takes its name. The abundance of flightless birds is due, no doubt, at least to a certain extent, to the absence of carnivorous mammals, which has rendered flight altogether unnecessary. Of the two bats, there is much reason to fear that the first and most remarkable must be added to the steadily lengthening list of species exterminated by man, or, at all events, that it is a candidate for a place in that list at no distant date. The species in question is the New Zealand short-tailed bat (*Mystacops tuberculatus*), which has special claims to interest on account of being the sole representative of its genus. According to local naturalists, it is many years since the capture of a specimen of this bat has been recorded; the last instance known being apparently in 1871, when several examples were taken in Milford Sound as the sails of H.M.S. *Clio* were unfurled to dry. There is one skin in the Canterbury Museum from Westland, a second specimen is recorded from Wellington, and a third from Orepuki, although it is not stated when either of these was taken. That the species survived till much later than 1871 is indicated, however, by a skin received at the British Museum from one of the outlying New Zealand islands about 1890. Whether this bat still lingers in any of these islands remains to be proved, but, at any rate, it is exceedingly rare. The nearest relative of this bat appears to be a Malagasy species referred to in the chapter on the fauna of Madagascar. The second species of bat, *Chalinolobus morio*, is common to New Zealand and north-eastern Australia, and belongs to a genus ranging over Australasia and Africa.

Perching-Birds. In the perching or passerine order of birds the chough-like huia-bird (*Heteralocha gouldi*), the sole member of its genus, is notable on account of the extraordinary difference in the shape of the beak in the two sexes, a peculiarity unparalleled among other birds. Whereas in the cock the beak is of moderate length and strength, and starling-like, in the hen it is greatly elongated, curved, and slender. This appears to be a special adaptation to the manner in which these birds jointly obtain their food; this consisting chiefly of the grubs of the hu-hu beetle. These grubs burrow in decaying wood, which the male chisels out in woodpecker-fashion, while the female probes with her long beak in the hole made by her partner until she seizes the coveted morsel. If, however, she fail in this owing to the insufficient length of her beak, the male comes to her assistance by again pecking at the wood till she is able to secure the grub. In colour the huia is black with a white tail-tip and orange wattles at the sides of the ivory-like beak. Nearly allied is the saddle-back (*Creadion carunculatus*), which resembles the huia in its orange wattles; a third species with orange wattles is the wattled crow (*Glaucopis cinerea*), but these are blue at the base, while in its cousin, Wilson's wattled crow (*G. wilsoni*), these appendages are wholly ultramarine. Both species of wattled crows, which, like all this group, form an exclusively New Zealand type, resemble the more typical birds-of-paradise in the softness and gloss of their plumage, but are without the remarkable ornamental plumes.



MALE AND FEMALE HUIA-BIRDS

Another member of the passerine group to which attention may be specially directed is the tui or parson-bird (*Prosthemadera novæ-zealandiæ*), which belongs to the honey-eater family (*Meliphagidæ*), and alone represents its genus. About equal to a starling in size, it is for the most part black, with a metallic gloss of various tints and a pair of tufts of curly white feathers on the sides of the throat from which it derives its English name. In a well-known work on the early history of New Zealand reference is made to the current belief among the coast-population in the existence of an unknown bird or phantom, which, though never seen, makes its presence felt by rushing through the air with a loud whizzing sound. By whalers the producers of the sound were called "break-sea devils," from the name of an island where the phenomenon is, or was said to be, common. The Maoris, on the other hand, attribute the sound to a bird furnished with many joints in its wings. These stories, it appears, are based on the notes of the tui, a species which formerly frequented the primeval forests of New Zealand in great numbers, but now stands in imminent danger of extermination. According to a local observer, the tuis have the habit of flying at a great height from place to place, rising, it may be, from a deeply wooded glen at a gradual angle and flying regularly till they reach their destination at a great height, when they suddenly drop with a rush into the scrub below. It frequently happens that two or three birds perform this evolution — apparently as a kind of sport—in company, and when this takes place the noise as they rush through the air can be heard at a distance of a quarter of a mile. The impending extermination of these beautiful birds is attributed to their being taken in great numbers for the sake of their plumage, coupled with the fact that the honey-yielding flowers on which they feed are now rifled by starlings and other introduced species. In fine weather tuis mount into the air in parties of half a dozen, turning, twisting, throwing somersaults, dropping from a height with expanded wings and tail, and performing other antics, till, as if guided by some preconcerted signal, they suddenly dive into the forest and are lost to view.

THE TUI OR PARSON-BIRD.

Rails. With the weka rail, or wood-hen (*Ocydromus australis*), which is a native of New Zealand and the neighbouring islands, we come to the first of the species which seldom or never fly. The weka, which is about the size of an ordinary hen, still retains the power of flight, although it depends mainly upon running to escape from danger. It is nocturnal in habits, and an inveterate egg-stealer, doing much harm in the reserves where the native birds receive Government protection. A second species of the same genus inhabits New Caledonia.

Special interest attaches to a much larger member of the same group, the tahake, or Mantell's gallinule (*Notornis mantelli*), now almost, if not completely, exterminated. In size this bird is nearly the equal of a turkey, while in colour it is indigo-blue, with the under wing-coverts white, and the beak and feet red. In general appearance it may be compared to an overgrown moorhen, but with shorter and thicker toes, a smaller forehead, and the primary quills of the wings so short and yielding as to be quite useless for flight. This strange bird was first described in 1847 by Sir R. Owen on the evidence of fossil bones forwarded from New Zealand by Dr. Walter Mantell. In 1849 Dr. Mantell's son obtained the skin and bones of a specimen from sealers who had caught it with the aid of their dogs on the south coast of the Middle Island. In 1852 another specimen was killed on Secretary Island, opposite Deas Cove, Thompson Sound. The bones were thrown away, but the skin was preserved. Twenty-seven years elapsed before any further trace of the bird was found, and it was supposed to be extinct; but in 1879 a man was catching rabbits in a place called the Wilderness, on the eastern side of Lake Te Anau, when his dog brought him a specimen alive. It was killed, and hung up to the ridge-pole of a tent, where it was seen, recognised, and eventually sent to England. This specimen was sold by auction in London in 1882 for £110, and is now in the Dresden Museum. In 1884 part of a skeleton was found near the southernmost arm of Lake Te Anau; and it is preserved in the Dunedin Museum. Another specimen was obtained alive in 1898, since which date nothing appears to have been heard of the species. A second species (*N. alba*), which was wholly white, formerly inhabited Norfolk and Lord Howe Islands.

Parrots. Two generic types of parrots, one of which spends much of its time on the ground, are amongst the most characteristic of New Zealand birds. The first of these is the kakapo, or owl-parrot (*Stringops habroptilus*), in which the wings are short and seldom used for flight, and then only for short distances. On the ground, however, this bird is extremely active, and it is but seldom that it leaves this for trees. The general colour of the plumage is mottled green; and the softness of the whole plumage and disc of feathers round the eye, coupled with the nocturnal habits of the bird, have given rise to the name of owl-parrot. The name *S. greyi* has been applied to a specimen which is probably only an abnormal variety of the typical species. Kakapo inhabit both open forests and mountain districts, where they lay their two or three eggs either in a burrow at the root of a tree or in clefts of rocks. Their cry has been variously described as a groan, a croak, and a shriek. So averse to flight are these parrots, that they are successfully hunted by the Maoris, and, in fact, are in danger of extermination. It is asserted that the kakapo breeds only once in two years. This, however, is not all, for it is stated that, in place of some individuals nesting in one year and others in the succeeding season, the whole of the birds will breed in one particular year, while in the following year none will do so.

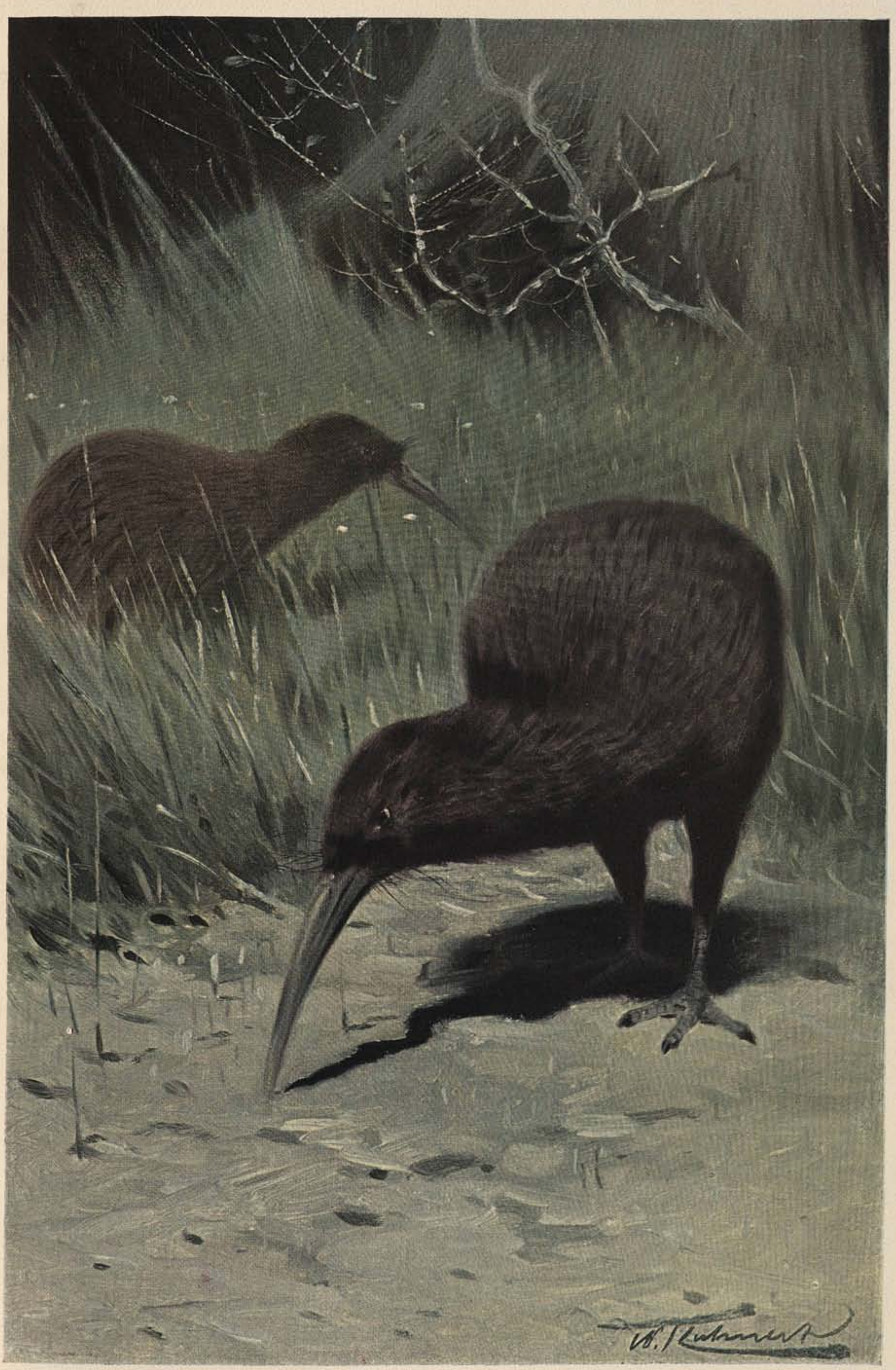
It is also stated that "months before the appointed breeding-season the male is developing an air-sac in his throat which he can puff up like a drum, and which may act like a sounding-board to assist in making the curious drumming notes in the spring. This note is not unlike the boom of the bittern, but is repeated five or six times in succession, and can be heard at a great distance. . . . It appears as if the breeding-season were controlled by the males, for when there is no drumming in the early summer, there are no eggs or young ones."

The second type is represented by the kaka (*Nestor meridionalis*) and the kea (*N. notabilis*) of the South Island. These parrots bear no near relationship to the kakapo, from which they differ by the long curved beak, the absence of a disc of feathers round the eye, and the more or less uniform olive-brown or olive-green of the plumage. In marked contrast to the kakapo, they are strong fliers. The genus also includes *N. norfolcensis* of Norfolk Island, and *N. productus* of Phillip Island, both of which are extinct. According to the observations of a local naturalist, the kea is confined to the mountainous districts of the South Island, in the provinces of Canterbury, Otago, and Westland; and although it has been seen among the glaciers, and is frequently observed on the open alpine and sub-alpine mountain-sides, it may be regarded as essentially a denizen of the forest limit, being abundant at the junction of the forest and the sub-alpine meadows, and in the beech-forests at lower levels where these are traversed by river-beds. Although living in a region where the cold and severity of winter are great, it is remarkable that the kea builds its nest, lays its eggs, and

KAKAPO, OR OWL-PARROT.

hatches its young during June and July, the coldest months of the year. During this season its habitat is swept by severe storms, and the ground—at an elevation of from 3000 to 4000 feet—is covered for months with snow to a depth of several inches. The nest, which is a mere hollow in the ground, sometimes bare and sometimes lined with a little grass, is on some occasions placed deep down in a fissure or crevice in the rocks, and is entered by means of a 'run'; but it may be situated in a cave, under a heap of rocks or stones, in a bank, in a deserted rabbit-burrow, or even on the flat. In one instance, the number of eggs in a clutch was four. The young are usually hatched about the end of July; they remain in the nest for an unusually long period, and are very slow in their development. A pair which were about two months old when received, and nearly the size of ordinary pigeons, were, for instance, unable to move about, or even to swallow food without assistance. For some years the kea has been persecuted to the verge of extermination on the charge of sheep-worrying; and circumstantial accounts of this misdemeanour have been published. It is stated, for instance, that the bird pecks a hole in the side of its victim with its powerful beak so as to wound the intestines, the animal being generally left in a moribund condition. Further, the lacerations are said to be made almost invariably about the same spot, thus suggesting a deliberate purpose on the part of the aggressor, although what this purpose may be does not appear to have been definitely explained. The bird is, however, also reported to feed on carrion in addition to its proper diet of fruit, seeds, and grubs; and it has been supposed to make a meal off some portion of the sheep's interior. In some districts about one in every 300 sheep is reported to fall a victim to the kea. At a conference of naturalists held a few years ago at Wellington the truth of the charge was, however, disputed. All the members of this conference were men well acquainted with the bird in its native haunts, but not one of them, either as the result of his own experience or from the testimony of others, was able to adduce evidence in support of the alleged sheep-worrying charge. Moreover, all the reports of the alleged habit were traced to a single valley on Lake Wanaka, and apparently to a single unknown observer, while a tame kea kept under observation was stated to have persistently refused to look at any kind of animal food. The result of the conference was a verdict that the whole story was a myth, although it was added that the charge must be regarded as non-proven rather than absolutely disproved. The opinion of the meeting was to the effect that as the kea is of a very inquiring disposition, the charge originated from one of these birds having been seen surveying the carcase of a sheep in its own peculiar fashion. Later on, however, a local naturalist wrote that these doubts as to the carnivorous habits of the kea were not justified by the facts; and it now seems to be admitted that the accusation against the kea of worrying sheep for the sake of feeding on their flesh is fully proved, and it is likewise agreed that the prime object of attack is not the kidneys and kidney-fat.

Godwit. Omitting mention of a host of species less peculiar than the foregoing, reference may be made to the New Zealand godwit (*Limosa novæ-zealandiæ*) on account of the fact that it migrates annually from New Zealand to eastern Siberia. The migrating birds leave the extreme north of New Zealand early in April, to reappear usually in the first weeks of October.



Kiwi.

They seem to spend a couple of months in the far north, four months in travelling, and the remaining half of the year in their southern home, thus enjoying two summers in succession. When they arrive in New Zealand the godwits are in their winter plumage, but those which remain when their fellows fly north assume the brilliant summer dress, although they never breed, these non-migrating birds thus wearing a summer livery in winter.

Kiwis and Roas. By far the most interesting and aberrant of the existing birds of New Zealand are those miniature members of the ostrich group constituting the genus *Apteryx* and the family *Apterygidæ*. To these wingless birds, which are restricted to New Zealand and the adjacent islands, it is the custom in Europe to apply the collective name of kiwi, but it appears from the notes of a local observer that this usage is not justified, the name kiwi belonging of right only to the brown species, *Apteryx mantelli*, and its immediate relatives, while such species as *A. australis* and *A. oweni* are designated "roa" by the Maoris. An average-sized species may be compared in point of dimensions to a weka rail; and all these birds may be recognised at a glance by their long, curlew-like beaks, with the nostrils at the tip, the loose, long, brownish or greyish plumage, beneath which the rudimentary wings are completely concealed, and the stout, four-toed legs.

Kiwis, according to the observer referred to above, live in nearly the same situations as roas, but prefer open ground, while the latter seek the densest shade of the forest. Kiwis generally have white grubs in their stomachs, as well as big maggots, wire-worms, and such-like, while roas depend more upon earthworms, water-insects, and berries. When a roa becomes conscious of the presence of intruders it alters its usual stealthy gait to a loud tramp. Both these groups of birds obtain their food by probing in soft soil with their long beaks in the same fashion as snipe. Strictly nocturnal in habits, they spend the day in holes in the ground or beneath the roots of trees, where the cock also incubates the two elongated white eggs, which are so large that they cannot be covered by the sitting bird. Kiwis and roas lay, in fact, the proportionately largest eggs of any bird. The largest known species is *A. australis* of the South Island, which is rather light-coloured, with very soft plumage. The North Island *A. mantelli* is characterised by its deep reddish brown ground-colour; while *A. oweni*, the smallest of all, is light greyish brown, and ranges over both islands. The same is likewise stated to be the case with *A. haasti*, which is a larger and darker bird than the last.

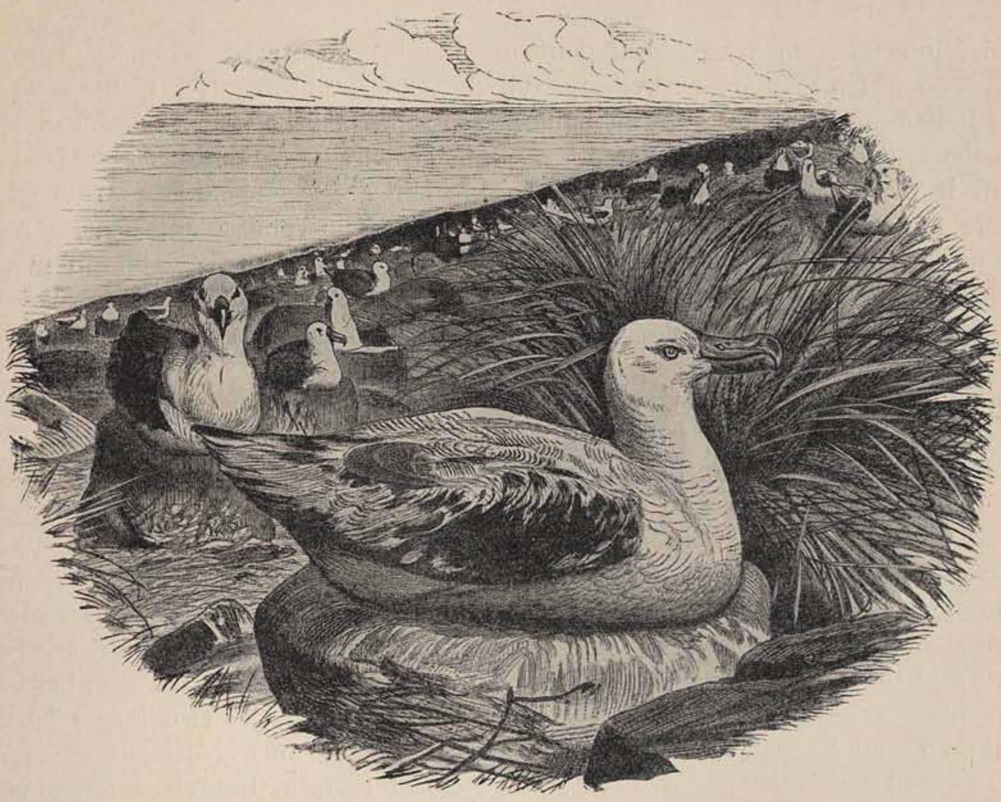
This brief notice of New Zealand birds cannot be concluded without mention of the extinct moas, or *Dinornithidæ*, a wingless group allied to the kiwis and cassowaries, which appears to have been exterminated by the Maoris about three centuries ago, or about a century after the reputed date of their arrival in New Zealand. The largest of these extinct birds, *Dinornis maximus*, stood about 12 feet in height, and thus far surpassed an ostrich in stature. There were, however, other species, belonging to different genera, which ranged down to the size of a turkey. The most robust in build of all was the elephant-footed moa (*Pachyornis elephantopus*), which was about the height of an ostrich, but had much stouter bones. Moas were furnished with extremely rudimentary wings, and a plumage of the general character of that of a cassowary or emeu. In addition to countless skeletons and bones, the feathers and eggs, as well as portions of the skin and tendons, have been obtained from the old Maori cooking-places.

Tuatera.

An apparently insignificant New Zealand reptile resembling a rather large lizard in general appearance is one of the most interesting animals in the whole world, for it is the last survivor not only of a family, but also of a distinct ordinal group, well represented in past epochs of the earth's history. To call this reptile, of which the scientific designation is *Hatteria punctata,* a lizard is a misnomer, for it has nothing to do with that group, and it is therefore much better that it should be known by its Maori name of tuatera. Although it formerly occurred on the mainland, where it was probably killed off by pigs, the tuatera is now confined to two small islands off the coast of the North Island, where it is yearly becoming scarcer. Measuring about 18 inches in length, the tuatera is easily recognised by the row of horny spines running from the crown of the head to the tip of the tail, where they become reduced to knobs. It is to the presence of these spines that the reptile owes its native name. Tuateras spend most of the day in sleep, and feed on animal food, which they capture alive. Between November and January the females lay about half a score of long, oval, white, hard-shelled eggs, which are deposited in holes in the sand where they can be reached by the sun's warmth. Tuateras are, as a rule, slow and sluggish in their movements, and are capable of remaining for hours under water without coming up to breathe. They excavate their own burrows, the accommodation of which is generally shared by a pair of petrels, and the terminal chamber measures only some 18 inches in length by 12 in width and 6 in height.

The palate of the tuatera is armed on each side with a double row of closely approximated cutting teeth, between which bite a very similar row of teeth surmounting the sharp-edged lower jaw. Skulls of the same general type, but in some cases of much larger size and with a more complex type of dentition, are met with in the Trias formation of Europe and India, and have been described under the name of *Rhynchosaurus* and *Hyperodapedon.* These extinct tuateras attest the antiquity of the type of which the New Zealand species is the sole survivor. There is, however, other evidence of the antiquity of the Rhynchocephalia, as the order to which all these tuateras pertain has been named. For if the head of a New Zealand tuatera be carefully dissected, it will be found to possess distinct remnants of a median Cyclopean eye; a structure which, judging from the aperture in the bones of the forehead for its reception, appears to have been common to a large number of extinct reptiles and salamanders.

Apart from the tuatera, the only reptiles inhabiting New Zealand are about a dozen species of lizards, half of these being geckos belonging to the genus *Naultinus,* which is unknown in any other part of the world. The solitary New Zealand frog, *Liopelma hochstetteri,* likewise represents a peculiar genus pertaining to the southern family *Discoglossidæ.*



WANDERING ALBATROSS ON THE NEST.

CHAPTER IV

SOME POLYNESIAN AND HAWAIIAN BIRDS

THE islands lying to the eastward of the Solomon group, which include those of the typical Polynesian area, are very difficult to classify from a zoological standpoint, more especially New Caledonia (of which some of the invertebrates have been already referred to). The New Hebrides and Fiji are inhabited by Melanesians, while those farther east, like the Tonga group, Samoa, and Hawaii, are the home of the Polynesians, which are of a Caucasian, and not a Negro, type. The true, or brown, Polynesians, commonly known as Kanakas, are met with in their greatest purity in the eastern Polynesian Islands; the Polynesians of Tonga having a strong infusion of Melanesian blood, while those of Samoa have a slighter strain of the same. Micronesians are Polynesians with a slight mixture of Mongol blood. Polynesians, who have more hair on the body and chin than Mongols, and range as far as Hawaii on the north and Easter Island on the extreme east, probably came originally from northern India, and gradually travelled by way of Java to the Pacific.

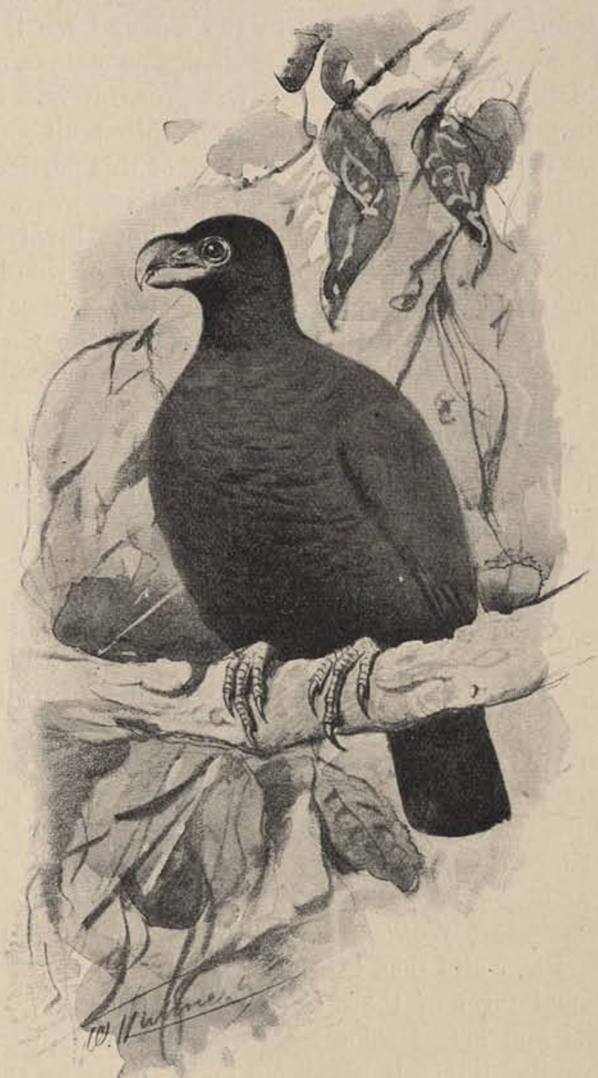
Exclusive of the Solomon group, which is here classed in the Papuan region, the Polynesian Islands have no indigenous mammals except a few bats, and their chief interest from a zoological point of view is concentrated on certain types of birds by which they are, or were, inhabited. It may, however, be mentioned that an Indian mongoose has been introduced into Fiji, with the same disastrous results to the fauna as when this destructive animal was turned loose in Jamaica. To Fiji it was introduced about 1885 to keep in check the hosts of rats which were at that time playing havoc with the sugar-cane plantations. "The result has been," writes Dr. P. H. Bahr, "that the rats are still found in plenty, whereas the more defenceless birds have suffered. To such an extent has the mongoose increased that it is now a common and obvious feature of the landscape. The rearing of domestic fowls has become almost an impossibility. Within the confines of our garden in Suva I had little difficulty in killing over thirty of these animals in less than a fortnight by means of two mongoose-traps. I frequently observed the mongoose spring on and successfully catch small birds feeding in the long grass. It has taken to climbing trees, and therefore the species building in more or less accessible positions, such as the parrots and the lories, have suffered most. The pigeons, which place their nests in the more slender branches, have to a much larger extent escaped. The harmless ground-snakes, once so highly prized by the Fijians as an article of food, have disappeared from Vitilevu, and it is said that even the land-crabs have shared the same fate. Luckily, however, the ravages of the mongoose are confined at present to the two larger islands, Vitilevu and Vanualevu, where sugar is grown on an extensive scale. The lovely and fertile island of Taviuni, in spite of certain ill-advised attempts at introduction, which happily have so far been frustrated, still remains free from this pest, and is a sanctuary to the birds peculiar to it." The Indian myna (*Acridotheres tristis*) has also been introduced into Fiji, with disastrous results to some of the native birds.

Kagu.

New Caledonia, the largest of the islands here classed as Polynesian, is the home of a very remarkable bird known as the kagu (*Rhinochetes jubatus*), the representative not only of a genus, but perhaps also of a family by itself. Ornithologists are, however, still in doubt as to its true affinities, for while it is generally admitted to have a distant kinship with the cranes, some writers assign it a position next to the Malagasy *Mesites*, while others regard it as widely different. Of the size of a large cock, the kagu may be at once recognised by its soft grey plumage, the crest of long pendent feathers at the back of the head, and the moderately long beak, with the nostrils placed well to the front.

The kagu was discovered at the time of the French occupation of New Caledonia in 1852, although not named and described till 1860, when a living specimen was shown at the Paris Colonial Exhibition. The general appearance of this grey bird, especially the long pendent, erectile crest of feathers at the back of the head, as well as its curious antics, are familiar from the specimens exhibited from time to time in the Zoological Gardens in the Regent's Park; but the specimens upon which the following observations are based were kept in the grounds of a private house at Sydney, where they bred. The nest was formed in a hollow in one corner of the aviary, and consisted only of a few coarse sticks and leaves. Only a single egg is laid, which is surrounded by more sticks, and this solitary egg is brooded continuously by the cock bird, relieved occasionally, perhaps (and if so, most likely at night) by his partner. Incubation lasts five weeks. If the egg be removed, another will be laid, and the process may be repeated two or three times; but in a state of nature it is probable that the birds would only lay one, or, at all events, would hatch only a single young one in the season. The egg itself is greyish stone-colour, sparsely marked with spots and blotches of dull grey and umber; and, except for the finer texture of the shell, might well be taken for a gull's egg. In captivity the birds were fed on chopped beef, of which they would consume a pound at a time; but they were very fond of large centipedes, which they would reduce to a pulp, by passing several times transversely through their beaks, and then swallow. In their native islands kagus live in pairs in the neighbourhood of the marshes, where they feed upon worms, slugs, beetles, frogs, etc., retiring to the scrub-jungle when not searching for food. There appears danger of this interesting bird being exterminated, unless measures are taken for its protection.

Tooth-Billed Pigeon. Samoa likewise possesses an aberrant type of bird in the shape of the tooth-billed pigeon (*Didunculus strigirostris*), which subsists entirely on animal substances, especially snails and worms. The beak, which forms one of its most peculiar features, is unusually strong and heavy at the tip, and has the upper half hooked and the lower half toothed, or rather serrated. This pigeon, which is related to the extinct dodo of Mauritius, and represents a family (*Didunculidæ*) by itself, would probably have long since been exterminated, had it not taken to nesting in trees instead of, as formerly, on the ground. As a result of this change of habit, an



TOOTH-BILLED PIGEON.

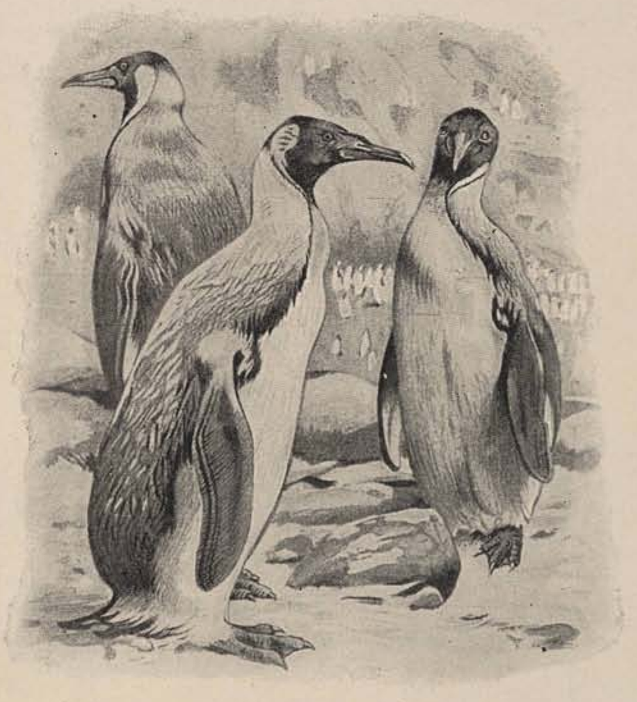
increase in the numbers of the species has been noticed of late years. In size this bird is about equal to an ordinary pigeon; in general colour it is black, with greenish metallic reflections on the head and throat, but the back, wings, and tail are reddish brown, and the black under-parts devoid of a metallic sheen.

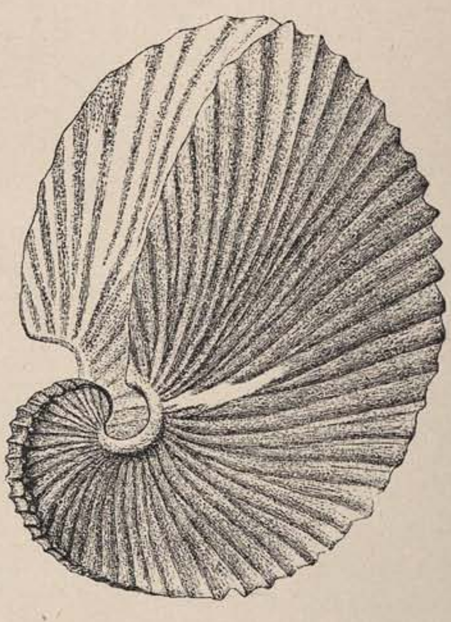
Mamo and O-o. One of the most beautiful of all birds is the mamo (*Drepanis pacifica*), of the Hawaiian Islands, a member of a special family allied to the honey-eaters (*Meliphagidæ*), but probably now exterminated; its disappearance being due to the demand for its brilliant yellow feathers. These were used for the great war-cloaks, or mamos, of the native chiefs, the most magnificent specimen of which was probably one belonging to King Kamehameha I., the great native conqueror who united all the islands of the group under his own dominion. The manufacture of this particular cloak lasted through the reigns of the owner's eight immediate predecessors; and since each mamo yielded only a few of the golden feathers, it must have involved the immolation of thousands of birds. It is therefore more a matter of wonder that sufficient birds were forthcoming for the purpose than that the species was exterminated. Small bundles of mamo-feathers were formerly paid by their followers to the chiefs; while the local kings employed at the same time a staff of men whose duty it was to trap the mamos with lime. Another Hawaiian bird yielding golden feathers is the o-o (*Acrulocercus nobilis*), a member of a genus of honey-eaters with several other species. The o-o used to be captured alive, and after being deprived of its golden feathers, was set at liberty; but the golden plumes of the mamo could be obtained only by the death of their owner. Consequently the mamo became killed out while the o-o still survives.

Other Species. The mamo is, however, not the only Hawaiian bird which has been exterminated during the historic period, the same fate having apparently overtaken a peculiar kind of rail known as the maho (*Pennula ecaudata*) which, and the allied Hawaiian *P. sandvichensis*, are the only representatives of the genus. Several other kinds of birds indigenous to the Sandwich group also seem on the verge of extinction. This is partly due to the destruction of the forests, and partly to the introduction of foreign birds of a more aggressive type.

Californian Linnet. It may be added that the Californian linnet (*Carpodacus frontalis*) was introduced into the Hawaiian Islands about forty years ago, and that the males of the race now established there differ from the normal form of their continental brethren by the replacement of the crimson head and breast colouring by yellow or orange. This pale colouring of the cock Hawaiian linnet is paralleled sporadically by the linnet of the mainland in a wild state, and constantly in birds kept in confinement. As the change in the Hawaiian bird does not appear to be due to differences in temperature or humidity, change of food, or a diminution in the number of foes, it may probably be connected with deep-seated factors, one of which is perhaps insularity of habitat.

THE SOUTHERN AND EASTERN OCEANS





LESSER SHEATHBILLS.

CHAPTER I

The Animals of the Antarctic

Having in the preceding section got so far south in this zoological survey as New Zealand, it will be convenient in the present chapter to discuss the faunas of the coasts, islands, and oceans of high southern latitudes, after which, in the succeeding chapter, we may again proceed north in the direction of the Indo-Pacific Ocean. So far, at any rate, as its animals are concerned, this great southern tract may be taken to embrace not only the Antarctic proper, but the coasts extending from this to about the thirtieth degree of south latitude.

Geological evidence indicates that the Arctic region used to enjoy a mild climate and formed a large continental area, which, in the opinion of some, served to a certain extent as a centre of dispersal and radiation for animals in the northern hemisphere, and it has been argued from this and other evidence that very similar conditions formerly prevailed at the opposite pole. This theory receives support from recent discoveries indicating the large area still occupied by the Antarctic continent, and from the occurrence of a fossil flora in high southern latitudes which must have required a comparatively warm climate for its development. The Lower Miocene marine deposits of Patagonia, New Zealand, and Australia, which are certainly of littoral origin, likewise afford evidence of an inter-continental connection in later Tertiary times in high latitudes. Further testimony to the same effect is adduced from the present faunas of the great southern continents, more especially from beetles and other insects. The idea that such resemblances as exist between the different southern faunas may be explained by what has been termed convergence is considered to be untenable, as convergence consists in resemblances between different groups, not in the likeness of allied forms. A South Polar union of the southern continents in later Tertiary times is therefore considered by some of those who have paid special attention to the subject as fully demonstrated.

The dreary ice-fields and icebound coasts of the Antarctic continent and its immediate neighbourhood need not form the subject of description on the present occasion. Reference may, however, be made to a few of the features of the Falkland Islands as an example of the physical features of less distinctly Antarctic lands. Although the Falklands are often supposed to present an example of utter desolation, this is not really the case, the vegetation being abundant in places, and the shores of the caves and estuaries in certain parts of the West Falklands being fringed with bushes of the striking and handsome Falkland box (*Veronica decussata*), which produces beautiful and highly scented flowers. Much of the country is, however, covered with peat-bogs, which are traversed in places by "rivers" of moving blocks of stone. On the peat itself bog-balsam (*Bolax globaria*) grows in great globular masses, some of which often persist in the middle of the "stone-rivers," owing to the length of their roots, which much exceed those of other bog-plants, and are thus able to retain a hold in the subjacent soil.

Falkland Fox.

The Falkland Islands are, or rather were, the home of a member of the dog and wolf family, in connection with which a considerable amount of adventitious interest has been aroused. This animal (*Canis antarcticus*) was associated in the early part of the nineteenth century with the so-called foxes of South America, and was referred to by Darwin as a wolf-like fox. Later on, however, an idea was started that this animal was related to the coyote of North America and the jackals of the Old World; and much ink has been wasted in the endeavour to account for such an apparently strange anomaly in geographical distribution. As a matter of fact, the Falkland fox, or Falkland, or Antarctic, wolf, as it is frequently termed, is undoubtedly an overgrown and superficially wolf-like member of the group represented by the South American foxes, which, as stated in an earlier chapter, are not foxes at all, in the proper sense of that term. Some years ago an English resident in the Falklands endeavoured to obtain a specimen of *C. antarcticus*, and eventually came to the conclusion that it had been completely exterminated, the last known individual having apparently been killed about the year 1876. A mounted specimen is exhibited in the Natural History Branch of the British Museum.

Sea-Lions and Sea-Bears.

The Antarctic area is the home of a considerable number of species of seals, some of which belong to the typical earless family (*Phocidæ*), while others, commonly known as sea-lions and sea-bears, belong to the family *Otariidæ*, or eared seals, so called from the circumstance that they retain rudimentary external ears. All these sea-lions and sea-bears are nearly related to those inhabiting the shores and islands of the North Pacific. The earless Antarctic seals, on the other hand, belong to genera quite distinct from those found in northern seas; the only genus represented to the north of the equator being the elephant-seals, one species of which migrates at a certain time of the year as far north as the coast of California. Walruses are entirely unknown in the southern seas.

The largest of the southern eared seals is the Patagonian or Falkland sea-lion (*Otaria jubata*), in the old males of which the hair of the neck is elongated into a kind of mane. The northern range of this handsome species—now greatly reduced in numbers—extends to the estuary of the Rio de la Plata on the east, and to the equator on the west side of the continent. Adult males are golden brown in colour, but females are greyer. Both sexes, as well as the young, are darker on the feet than elsewhere; the young being deep chocolate-brown during their first year, but growing paler later. During the pairing-season, the old males fight each other fiercely, while the females look placidly on. At this season the old males utter loud, long, occasionally interrupted, roars instead of the deep growls which form their ordinary cry. They are extremely savage during the pairing-season, and defend themselves resolutely against attacks. Many of these sea-lions inhabit more northerly latitudes for the rest of the year, and spend the months from July to November on the Falklands. Towards the end of the year, about the middle of the southern summer, the females give birth to their young, of which but one is produced by each parent in a season. This sea-lion, which was discovered by Magellan in 1579, was one of the first-known members of its family, as it was also the first to be exhibited in London. All these seals are not only of extreme agility in the water, but likewise display considerable intelligence.

The second Antarctic species is Hooker's sea-lion (*O. hookeri*), first discovered on the Auckland Islands, south of New Zealand, and distinguished by the nearly straight profile of the head. A third member of the group, the Australian sea-lion (*O. lobata*), does not appear to range so far south as its relatives. In regard to the character of its coat this species, which is classed as a hair-seal, tends to connect the more typical sea-lions, or hair-seals, with the fur-seals, or sea-bears, for in early life it is furnished with a thick under-fur, like that of the fur-seals, but this disappears in the adult. A well-known colony of these sea-lions on "Seal Rocks," in Bass Strait, is in flourishing condition under Government protection. In November 1908 a party of naturalists left Melbourne for a cruise in Bass Strait, and one of their number gave the following account of their visit to the sea-lions:—"As we approached this haunt of the seals, hundreds of the animals could be seen in the water, and from the rocks came, borne on the wind, the sound of their voices. The rookery presented a 'moving spectacle,' as we surveyed it through binoculars from the steamer's deck. Huge brown forms were clambering among the pools and darting in and out of the surf, while sleek cubs lay basking in the sunlight beside their anxious mothers."

Of sea-bears there seem to be four southern species, all of which differ from their northern relative by their sharper and more depressed muzzles, and the shorter flaps of skin projecting beyond the toes of their flippers. Of these, the South American species (*O. australis*) frequents the coasts of the American mainland as well as the South Shetlands, the Falklands, and Kerguelen Island, in all of which latter localities it is more numerous than on the mainland. The second species, the Cape fur-seal, or sea-bear (*O. pusilla*), is easily recognised by the great length of the bristles on the upper lip. Still not uncommon on several of the islands off the African coast, this seal appears to have formerly visited Tristan da Cunha, midway between the Cape and South America. In the New Zealand fur-seal (*O. forsteri*), which ranges from the south-western coast of Australia to the Chatham Islands, and is now very rare, the valuable under-fur, forming the seal-skin of commerce, is well developed in the males, but in the females is so scant that the two sexes have been regarded as separate species, of which one was a hair-seal.

Earless Seals.

The earless, or true, seals of the family *Phocidæ* are represented in the Antarctic by four species, namely, Weddell's seal (*Leptonychotes weddelli*); the crab-eating or white seal (*Lobodon carcinophagus*); Ross's seal (*Ommatophoca rossi*); and the sea-leopard, or leopard-seal (*Ogmorhinus leptonyx*). As already mentioned, all these four Antarctic seals are quite distinct from the seals of the Northern Hemisphere, and each represents a distinct generic type by itself. The four genera are well characterised by the dentition, that of the leopard-seal being the strongest and that of Ross's seal the most feeble. The leopard-seal, which is much the largest of the four, and attains a weight of about 850 lb., feeds almost exclusively on fish, and frequents the pack-ice. In Ross's seal, on the other hand, the teeth are remarkably weak, those of the molar series forming mere peg-like knobs, while the skull is extremely short, with feeble jaws. As might have been supposed, the food of this species consists of soft substances, such as cuttles and fleshy seaweed. The white or so-called crab-eating seal, which is a common species found on the pack-ice, is believed to feed upon small crustaceans of the genus *Euphausia*. During the summer, when the coat is being shifted, these seals apparently fast. Weddell's seal, which is a shore species, feeds on crustaceans and small fishes. Ross's seal is remarkable for the peculiar puffing-out of the breast, which is suggestive of an extremely corpulent pouter-pigeon. To seize and hold its slippery prey the leopard-seal has large tricuspid cheek-teeth and powerful tusks. When on the ice, it bulges out its sides until the whole body becomes flattened in much the same way as many lizards flatten themselves out when basking in the sun. This species, which grows to eleven or twelve feet in length, has an olive coat dappled with yellow and black, and ranges from the pack-ice to the coasts of Patagonia, the Falklands, Kerguelen Island, Australia, and New Zealand. The white seal takes its name from the pure creamy white colour of the coat at a certain season; but at other times the coat is greyish, more or less mottled with brown, especially near the flippers and tail, which are then wholly brown. The cheek-teeth are of a more complex structure than those of the leopard-seal, perhaps for the purpose of straining out the minute crustaceans on which this seal feeds. This species is stated to be the common seal of the pack-ice, at any rate during the months of the Antarctic summer. It is, however, by no means confined to this belt of ice, as it is also to be found sparingly as far south as the great ice-barrier, in company with Weddell's seal, which is the most common seal of Ross's Sea and South Victoria-land. Weddell's seal, which, as already mentioned, is a shore-seal, may be distinguished from the leopard-seal not only by the much simpler structure of its cheek-teeth, but likewise by the absence of deep black among its dark mottlings. In addition to the features already mentioned, Ross's seal is characterised by the colour of the coat varying from steel-grey to greyish brown, becoming darker along the middle line of the back, and nearly white on the under-parts. It is far from being a common species, and till about the commencement of the present century was known in Europe only by a couple of skulls brought to England by the great navigator after whom it is named. Its range appears to be restricted to the Antarctic pack-ice. Although this seal is about as unlike an adult male elephant-seal as can well be imagined, it is not a little remarkable that there is a very decided resemblance to young individuals; this indicating that all the Antarctic seals are nearly related to one another.

Sea-Elephants. So far as bodily size is concerned, the great lumbering walruses of the Arctic are represented in the Antarctic by the still more gigantic sea-elephants or elephant-seals (*Macrorhinus*, or *Mirunga*), males of both species of which may attain a length of rather more than twenty feet, although the females reach little more than half these dimensions. Here, however, the resemblance ceases, for while walruses represent a family by themselves, sea-elephants can only be regarded as overgrown true seals, related, as we have just seen, to Ross's seal. The most obvious characteristic of sea-elephants, next to their gigantic dimensions, is the short retractible and expansible trunk or proboscis of the adult males, or bulls as they are called by the sealers. The length of this trunk varies, however, considerably in the two species by which the genus is represented. In the typical *Macrorhinus leoninus* of Juan Fernandez, which, as mentioned in an earlier chapter, annually migrates northward to breed on Guadalupe Island and (formerly) the adjacent coast of California, the trunk is of considerable length, whereas in the southern *M. patagonicus* it is much shorter. Indeed, when bulls of the typical Juan Fernandez are compared with those of the Falkland race of the southern species, the latter can scarcely be said to have a trunk at all. The Crozet race of the southern species (*M. p. crosetensis*) has a little longer trunk, and the same is the case with the Macquarie race (*M. p. macquariensis*). On the other hand, the sea-elephants which formerly frequented the shores of King Island, in Bass Strait dividing Tasmania from Australia, are depicted in an old engraving with quite long trunks, and, if this be trustworthy, they may have represented a third species, now unfortunately extinct.

Like their Juan Fernandez and Guadalupe relative, the southern sea-elephants have been the object of unremitting persecution for the sake of their valuable oil for about a century and a half. So incessantly and severely, indeed, have both species been hunted, that the wonder is not that they are more or less nearly, if not completely, exterminated in many of their haunts, but that any of them survive. As regards the early history of this persecution, the naturalist Weddell stated so long ago as the year 1823 that sea-elephants were even then nearly extinct in South Georgia, whence some twenty thousand tons of their oil had been shipped to London, to say nothing of enormous quantities carried to other ports. At an earlier date, 1802, six hundred of these huge seals are reported to have been killed on King Island in the course of a period of ten weeks between the beginning of March and the end of May. Much important information with regard to the present condition of the sea-elephants in the southern ocean was acquired during the recent Antarctic expeditions, from which it appears that in the Macquarie Islands all the old males have been killed off, as no individuals were seen of more than eight feet in length, and all lacked the well-developed proboscis of the full-grown bull. A considerable number of young animals were, indeed, observed; but even this did not represent anything like the total, as these seals, despite their bulk, are so completely concealed by the clumps of tall grass amid which they lie that they require to be walked up to before their presence can be detected. A few years before the visit of this particular expedition, twenty tons of sea-elephant oil were obtained by a party of five sailors. This immaturity of the sea-elephants on the Macquaries raises the question as to how long these seals take to arrive at their full size—a question to which it is doubtful if it will ever be possible to give a complete answer. One piece of information acquired during the recent expeditions is that these seals occasionally wander much farther south than had been previously supposed. A half-grown male was, for instance, obtained by the *Discovery* party on South Victoria-land, at least a thousand miles away from the nearest island on which the species is known to breed; and a second specimen was reported from the South Orkneys by the Scottish expedition. These discoveries completely disprove the idea that sea-elephants never wander far from land. In New Zealand seas the Macquarie Islands are stated to form the northern limit of the species, which is unknown on the Auckland and Chatham Islands. Kerguelen, Marion, Heard, and Crozet Islands are other well-known resorts where the species was formerly abundant; while, in other directions, these seals inhabited Tristan da Cunha, Juan Fernandez, the Falklands, the South Shetlands, South Georgia, and Inaccessible Islands, and, it is reported, the Cape of Good Hope. With this essentially southern distribution it is remarkable that the typical species should wander for breeding purposes to the coast of California, north of the tropic of Cancer. Although sea-elephants belong to the same family as ordinary seals (with which they agree in the absence of external ears and the normally backward direction of the hind-flippers), they present certain resemblances to sea-lions and sea-bears. The bulls, for instance, as already mentioned, are nearly double the size of the cows, and also remain a long time on land in the breeding-season, during which they become emaciated by their fast; this being also a feature in which they resemble sea-lions. The old bulls do not, however, as is mentioned later, assemble 'harems' of cows after the fashion of sea-bears and sea-lions. Nevertheless, sea-elephants, like sea-lions, come on shore for the purpose of changing their winter-coats, as well as for breeding. From this community in habit and in the relative sizes of the two sexes it is inferred by the naturalist of the *Discovery* expedition that the sea-elephants, in place of being the most specialised of the true seals, are the most generalised, and the only ones which retain in these respects evidence of affinity with the eared seals.

In regard to the movements of these monstrous seals when on shore, it appears from the narrative of the expedition of the *Gazelle* (1874–76) that these monsters, when dragging themselves along on land, do not use their fore-flippers, but propel themselves by bending the hind-flippers forward and pressing them on the ground. On the face of it, such a mode of progression seems difficult to understand, if, indeed, it be not impossible; and according to the observations of the naturalist who accompanied the recent Swiss expedition to South Georgia, the statement appears to be erroneous. From this account it seems that when sea-elephants move on land they employ only their fore-flippers, supported on which they throw themselves forwards with undulating movements of the body, and drag the hind-flippers in a limp condition. In spite of their bulkiness and the awkwardness of their movements, they are able to crawl considerable distances inland, frequently reaching situations of at least 600 yards from the water, and in some cases from 40 to 60 feet above sea-level. When in these resorts, the old bulls frequently raise their bodies to such a height that the fore-flippers are completely above the level of the ground, this being done in order to obtain a view above the tussocks of grass. When irritated by the approach of a human being these old bulls will often raise themselves to a still greater height, the body resting on the pelvic region alone, and the whole fore part being lifted vertically, so that the front flippers are midway between the head and the part resting on the ground. Nevertheless, they are generally too lazy to attack the intruder, although a direct frontal approach on the part of the latter may be dangerous. When an attack is made, it is straightforward, and an alert man can consequently generally escape by jumping quickly to one side. On the other hand, an old bull is exceedingly nimble in spinning round on his axis in teetotum fashion.

The following are the exact words in which this curious movement is described by the naturalist to the *Discovery* Antarctic expedition :—"When brought to bay on land by treading on some portion of the tail-flippers, the animal swings round the hinder portion of its body and shows a threatening front with its open mouth. The motion is very characteristic, both ends are off the ground at the same moment, the hind-flippers and tail swinging high into the air, while the head and neck are reared up, and the animal edges itself into a frontal position with the help of its fore-limbs and a kind of backward shuffle." It is also stated that when a male asleep on the shore was approached the animal suddenly awoke and raised himself well up on his fore-limbs so as to present his broad, blunt muzzle to the party.

Although the old bulls will apparently lie for weeks with their partners on the high tussocky ground without once returning to the sea, it appears that, as a rule, they are strictly monogamous. On a certain occasion, however, two cows were seen in company with one bull. When two bulls fight, they first puff out their necks, inflate their trunks, and open their huge mouths to their fullest extent, after the manner described in the account of Lord Anson's voyages. Next, they elevate their bodies nearly into the position described above, although not to quite so great a degree, and almost immediately afterwards throw themselves forwards against one another, trying to fix their powerful tusks in the head or neck. If they succeed in this, large pieces of skin, or skin and flesh, are torn off, leaving huge gaping wounds, which, however, soon heal. With much roaring the fight is continued till one of the combatants feels himself defeated, and commences to retire—never pursued by the victor.

The following additional particulars, obtained during the visit of the United States surveying vessel *Albatross* in March 1911, with regard to the sea-elephants on Guadalupe Islands will be of interest. When the vessel had come to its moorings and a boat-party had been sent on shore, a herd of one hundred and twenty-five of the great seals was located on Elephant Beach. This herd consisted chiefly of adult males, including not more than fifteen females, of which only half a dozen were accompanied by newly born 'pups,' thus indicating that the breeding season had just commenced. Three of the largest males were killed for museums, and likewise an adult female, the former averaging 16 feet in length by 11 feet in girth, while the latter was close on 11 feet in length. Males of 22 feet in length have, however, been previously recorded. The 'pups,' which appeared to be about a week old, were dusky black in colour, and quite different from the yearlings, which were greyish brown. The old males frequently engaged in fighting among themselves, although such combats were far less serious than those which take place between male sea-bears, there being apparently no actual seizure by one combatant of the skin of the neck of the other, and the head being quickly withdrawn and raised aloft after the infliction of every blow. The nursing females were in most cases accompanied by a yearling as well as by a newly born pup. Some of these yearlings were captured without difficulty by throwing over them pieces of heavy netting in which they were tightly rolled. When the *Albatross* left Guadalupe Island on 4th March there were not less than one hundred and twenty-five sea-elephants on that part of the island, but as it is practically certain that the tale of females was then incomplete, the total number of the herd may be roughly estimated at one hundred and fifty head. In addition to recording the black colour of the newly born young, the naturalist to the expedition claims to have discovered that the trunk of the old males is incapable of being inflated, and that it is retracted into heavy folds on the top of the head by muscular action. The breeding-season commences about the end of February, and the period of gestation is twelve months. It has also been noticed that the yearlings emit a cry or scream unlike the voice of any other seal; and that in captivity the favourite food of young sea-elephants is fish.

It may be well to add that in addition to visiting Guadalupe Island, which is situated about one hundred and fifty miles off the coast of the peninsula of Lower California, the Juan Fernandez sea-elephants (*M. leoninus*, but often miscalled *M. angustirostris*) resorted in former days to the shores of the mainland, where they ranged from Cape Lazaro to Point Reyes. In 1890 the species, which seems to have completely deserted its original home on Juan Fernandez, was believed by American naturalists to be practically extinct, as the existence of the Guadalupe herd was at that time unknown.

In the Falkland Islands, South Georgia, and the South Shetlands, elephant-seals are being relentlessly slaughtered at the present day for the sake of their oil; and unless steps are taken by the British Government to regulate the slaughter, it is only too likely that these seals will share the fate that has already befallen their relatives in other parts of the southern ocean.

Whales and Dolphins.

One of the results of the numerous recent expeditions to the Antarctic is to render it practically certain that the ocean surrounding the southern pole does not possess a giant whale of its own comparable to the Greenland whale of the Arctic.

In the accounts of earlier Antarctic exploration, reference is made to a black whale frequenting the neighbourhood of the ice-cliffs, specially characterised by its high back-fin; the writers distinguishing it from the grampus or killer, which is a pied species. Nothing more appears to have been heard of this Antarctic ice-whale till the naturalist to the *Discovery* expedition announced that three of these whales were seen at comparatively close quarters off Ross's Great Ice-Barrier on 28th January 1902, and four others on 8th February of the same year. They are described as being black above, with a certain amount of white on the chin; their length is estimated at between 20 and 30 feet, while the height of the narrow, upright, back-fin, forming the most characteristic feature of the species, appeared to be between 3 and 4 feet. This fin curves slightly backwards, although in one apparently abnormal individual the direction of the curve was forwards. These whales were noticed to be slow swimmers, and as they rose to the surface the 'spout' became noticeable just as the top of the back-fin made its appearance above the water. Immediately afterwards the short and blunt muzzle was exposed. That these whales, which not improbably belong to the whalebone group, indicate an undescribed species and genus seems practically beyond doubt.

Another, and at the same time a perfectly well-known, Antarctic cetacean is the pigmy whale (*Neobalæna marginata*), which is the sole representative of its genus, and attains a length of not more than about 20 feet, and is thus one of the smallest of the whalebone-whales. The head does not exceed about one quarter the entire length of the animal, the throat is devoid of the longitudinal grooves, or pleatings, characteristic of the rorquals, but there is a small, sickle-shaped back-fin, and the flippers are relatively short. The number of dorsal vertebræ is seventeen or eighteen, which is greater than in any other species of whale; and the seventeen pairs of ribs are unusually broad and flat. The seven vertebræ of the neck are fused together, as in the Greenland and other right-whales. For the size of the head the whalebone, which is white and flexible, is relatively long, although not of sufficient length to be of much, if any, commercial value. The species has a wide distribution in the southern ocean, occurring off the Australian as well as the South American coasts.

A representative of the black right-whale of the northern Atlantic (*Balæna glacialis*, or *B. biscayensis*) is found in the southern seas, but whether it constitutes a species by itself (*B. australis*), or whether it is merely a local race of the former, is a question not yet definitely decided.

Rorquals or finners, apparently identical with the European *Balænoptera musculus* and the still more gigantic *B. sibbaldi*—the biggest of living animals—as well as some of the smaller species, visit the Falklands, the South Shetlands, South Georgia, and other parts of the sub-Arctic in thousands. As these whales have been already referred to in the chapter on the fauna of the northern seas, it need only be mentioned here that they are the "clipper-built" racers of their tribe, and that their whalebone, owing to its shortness, is of comparatively small value, so that they are mainly hunted for the sake of their other products. The nature of their food varies according to season and opportunity. The common rorqual (*B. musculus*) is known, for instance, to feed largely on smelts, herrings, and other small fishes, but in August it has been found feeding, in company with the blue rorqual (*B. sibbaldi*), off the coast of Mayo on the small shrimps known as *Meganyctiphanes norvegica*. In spring the blue rorqual is reported to feed entirely on the small crustacean named *Euphausia*, or *Rhoda, inermis*. The smallest, Rudolphi's rorqual (*B. borealis*), on the other hand, is stated to feed entirely on crustaceans, consuming not only the species just named, but likewise the much smaller kinds known as *Calanus finmarchichus* and *Temora longicornis.*

To capture such racers with the old-fashioned hand-harpoon was difficult and unprofitable, especially since, if struck, they are quite likely to turn on their pursuers and smash the boats. Moreover, as their whalebone is of very little value and their yield of blubber relatively poor, rorquals were for the most part left alone in the old days of whaling, and they accordingly increased in numbers, and swarmed in almost every sea except the Arctic. A day of reckoning was, however, to come, and at the present time the destruction of rorquals is so great and so rapid that fears of their extermination from some seas have been entertained. The doom of the rorqual is due to the Norseman, Sven Foyle, who early in the second half of last century invented the exploding and expanding harpoon, the latest form of which is a really terrible weapon.

The modern harpoon weighs about one hundredweight, and is so made that its iron shank fits the bore of the gun from which it is fired; the latter being mounted in the bow of the whaling vessel. Through the length of the shank runs a slot like the eye of a huge needle, in which travels an iron ring, carrying the line. The shank is hidden in the gun as far up as the front end of the slot; and just in front of this are four iron barbs attached by hinges to the shaft and held fast by a cord round their tips. After being fired, this cord is stripped off by the impact against the whale, when the four barbs spread out in the body of the latter directly the line becomes taut. A pointed cone is screwed on to the shaft in front of the barbs. This cone, which is of cast-iron and measures 14 inches in length, with a basal diameter of 3 inches, weighs about a dozen pounds and carries a charge and friction-fuse. This fuse is connected to a wire which, after passing through a hole in the nozzle of the shaft, is made fast to the cord holding the barbs. When the cord is snapped by the weapon striking the whale's flank, the fuse is fired and the bomb, buried deep in the monster's body, explodes.

With such a weapon a rorqual can be hit and killed at 30 or 40 yards' distance; and within five minutes of firing, the carcase will be hauled up alongside the whaler. In the old days of Greenland whaling the carcase was stripped of its blubber and whalebone at sea and cast adrift; but the Norwegians utilise practically the entire whale, which after being rendered buoyant by the injection of steam, is towed to the whaling-station, where it is hauled, tail-forwards, despite its weight of from 35 to 70 tons, by machinery up an inclined stepway to the flensing platform. After all the oil has been extracted from the flesh and bones by high-pressure steam in the metal cylinders in which they are treated, the solid residue is dried and ground up and sold as a fertiliser under the name of whale-guano. The whalebone of the larger rorquals realises from £40 to £50 per ton, but that of the smaller kinds is worthless.

Humpbacks, as represented by the widely spread *Megaptera boöps,* which also visits the Antarctic in great numbers, are shorter and more heavily built cetaceans than rorquals, although perhaps, on account of the much greater length of their flippers, they may be nearly as rapid swimmers. In any case, they are just as difficult to catch; and they do not appear to have been regularly hunted previous to the use of explosive gun-fired missiles. The long flippers, black or piebald in colour, with serrated front edges, render them easy of recognition. The black whalebone is narrower than that of rorquals. Of late years humpbacks have been regularly hunted—presumably by Norwegians—off South and East Africa, where they abound, as well as in South Georgia.

In addition to stations on their own coasts, in the Shetlands, on the coast of Mayo, and elsewhere in the Northern Hemisphere, the Norwegians are killing rorquals by the thousand off South Georgia and in other parts of the Antarctic Ocean. This fishery is leased to Norwegians by the British Government; but unless proper means are taken for the restriction of the slaughter there is every probability that the golden goose will be killed. In other words, whaling will become no longer profitable; and when that time comes the whales will have a chance of recuperating; but this must be a long process, for whales, as a rule, are slow breeders; one calf being generally produced at a birth, although rorquals and humpbacks not infrequently have twins. As to the age at which whales breed, there is probably no authentic information, the same being the case with regard to the duration of pregnancy; but in any case the rate of increase must be comparatively slow, and it is certain that wherever whaling is practised with the energy characteristic of the Norwegian stations the rate of reproduction can bear no proportion to that of the destruction. As an indication of the appalling extent of their slaughter, it may be mentioned that during the whaling-season of 1911 the number of whales taken in South Georgia was 7000, in the South Shetlands 3500, and in South African waters 4000, while the total number killed in the same season throughout the Southern Hemisphere was estimated at 17,500 head, with a yield of 500,000 barrels of oil, and a net value of £1,750,000. This does not represent anything like the world's catch of whales during the same season, for in the Northern Hemisphere (exclusive of the Japanese, Dundee, New Bedford, and San Francisco fisheries) something like 5000 whales were killed, these yielding about 156,000 barrels of oil, with a cash value of £625,000. In estimating the extent of the drain on the whales in the southern seas, it is important that this item should not be overlooked, as several of the species, especially the humpbacks on the east coast of Africa, are known to make extensive seasonal migrations, so that a school which has been hunted at one season to the north of the equator may be attacked at another to the south of the same. The world's total catch in 1911 was estimated at 22,500 whales, with a yield of 620,000 barrels, or 103,000 tons, of oil, and a value of between two and a half and three millions sterling. This take was twice as large as that of 1910. If these figures relating to the southern fishery be contrasted with some of those of the whaling in the Northern Hemisphere, a better idea will be gained of the enormous extent of the slaughter in the case of the former. As regards northern whaling, it appears that between the years 1814 and 1823 the number of Greenland right-whales taken by British vessels was 12,907, between 1824 and 1833 the catch had fallen to 9532, while between 1834 and 1843 it was only 1221. These figures bear no sort of comparison with those of the fishery in the southern seas, the Greenland whale having been always much less numerous than either finners or humpbacks, but they, nevertheless, heralded its practical extermination. A further serious matter in connection with Antarctic whaling is that a considerable percentage of both the finners and humpbacks killed at the whaling-stations consists of gravid females.

The Antarctic is, however, by no means the only region in the Southern Hemisphere where finners are hunted, for there is an important tropical whale-fishery at Bahia, in Brazil, which gives employment to a large number of fishermen from June to the middle of September. The whales, which are almost exclusively the common fin-whale, usually begin to arrive off the Brazilian coast from the south about the middle of May, and from that time to the end of September the waters along the coast from Assu on the north to Cannavieras on the south, a distance of some 300 miles, swarm with whales, this strip of seacoast being apparently their breeding ground. The Bahia whalers employ old-fashioned and inefficient methods in the capture of the whales, using open sailing boats of about thirty feet in length, with a crew of eight or ten hands, and ordinary harpoon and lances. The carcases of the whales have to be towed to Itaparica Island, in Bahia Bay, where the "trying-out" works for boiling down the blubber are situated, and head-winds or rough weather often cause the loss of the catch. The yield of oil is usually about 700 gallons, but large whales produce 1200 gallons or more. At the end of September the whales take their departure in a body, all heading north, and being no more seen until the following season, though the route of their migration is a mystery.

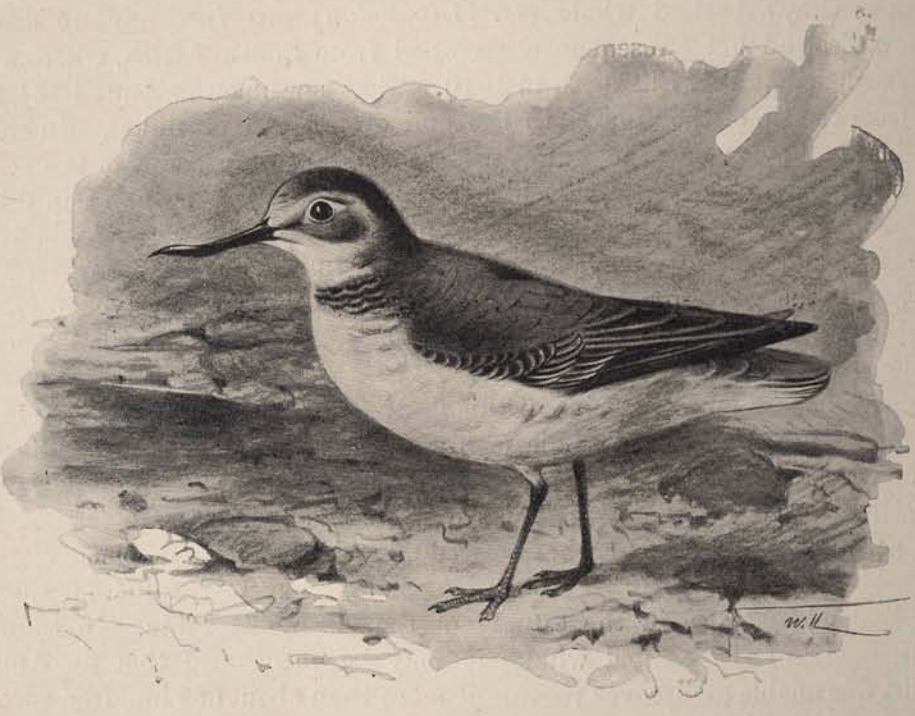
While, as we have just seen, the rorquals and finners which visit the sub-Antarctic coasts appear to be inseparable from northern species, the southern seas are the home of several kinds of beaked whales (*Ziphiidæ*) apparently unknown elsewhere. All the beaked whales, as is more fully noticed later, are comparatively rare, and appear to go about in pairs instead of in the large "schools" formed by most of the members of other groups of cetaceans. One of the characteristic southern species is Layard's beaked whale (*Mesoplodon layardi*), which is not infrequently stranded on the South African coasts, and attains a length of nearly twenty feet. It is specially characterised by the great length and strap-like form of the single pair of teeth in the lower jaw (the only teeth this whale possesses), which grow continuously throughout life, and curve upwards so as to embrace the upper half of the long beak. In a specimen stranded some years ago near Port Elizabeth, which measured 19 feet 2 inches in total length, the colour of the back was dark brown, inclining to black on the dorsal surface, gradually merging to brown on the sides and tail, and becoming whitey-brown or dirty white on the belly. It has been suggested that this beaked whale, owing to the overarching of the strap-like teeth, must experience considerable difficulty in opening its mouth, but careful examination of this example proved that it was able to open its mouth from 4½ to 5 inches at the tip; the fleshy covering of the upper jaw beneath the teeth showing no mark or abrasion, indicating that the animal opened its beak only so far as the teeth allowed. Judging from the width of the gullet, the naturalist who examined the specimen came to the conclusion that this whale does not require to open its mouth very wide, as the gullet is only from 1¾ to 2 inches in diameter, indicating that the food consists of small morsels. The sharp, enamelled real tooth at the summit of the tusk is considered to be used for tearing and rending soft-bodied animals such as cuttle-fishes, and possibly for tearing aside seaweeds when in search of food. The tusks were 14 inches in length, 2½ inches wide at the jaw, 1⅝ inches at the summit beneath the conical real tooth, and from ⅝ to ½ inch in thickness. The flippers measured 22 inches in length; the back-fin, which is situated far back, was 13 inches wide and 11 inches high; the tail, 4 feet 6 inches across at its extreme width; and the interval from the point of the beak to the eye 38 inches, and to the end of the jaw 4 feet. The exposed portion of the teeth was 11 inches long and 2½ inches wide at the base, becoming slightly narrower towards the tip, which carried the conical real tooth at the front of its summit; this tooth being enamelled and sharply pointed.

Still more rare is the species known as *Mesoplodon densirostris*, which has also been taken in South African waters, and has teeth of a more normal type. A fourth is Gray's beaked whale (*M.* [*Dioplodon*] *grayi*), originally described from New Zealand but subsequently recorded from South Africa, where a specimen was stranded at Port Elizabeth in 1910. That specimen measured 15½ feet in length, from the tip of the muzzle to the end of the tail, or flukes. In colour it was jet-black all over; and the flukes was remarkable on account of the posterior border being convex, instead of deeply scooped out (emarginate), as in ordinary cetaceans. A feature similar to that found in the tail of the Port Elizabeth specimen is stated to occur in a beaked whale from Annisquam, Massachusetts, which is referred to the above-mentioned *M. densirostris*, a near relative of *M. grayi* (with which *M. australis* is identical), and it therefore seems that the former likewise belongs to the subgenus *Dioplodon*.

An equally rare representative of this group inhabiting southern waters is the species named Arnux's beaked whale (*Berardius arnuxi*), the sole member of its genus, and remarkable for the expanded triangular form of the single pair of large lower teeth, which are situated near the extremity of the jaw, instead of in the middle, as in Layard's beaked whale. Arnux's whale, which is black above and grey beneath, grows to nearly 30 feet in length, and has been taken off the coasts of New Zealand and also in the estuary of the Rio de la Plata. In connection with the rarity of the beaked whales it may be mentioned that an American naturalist was unable to discover records of more than about one hundred specimens in collections belonging to the aforesaid genera and to the northern *Ziphius*, the typical representative of the group; more than half of these belonging to the genus *Mesoplodon*, *Berardius* being known only by about fourteen examples. An important addition to our knowledge of the group was the discovery of representatives of all three genera at Bering Island in the western North Pacific, two of these being regarded as distinct species, which were subsequently ascertained to range into the eastern North Pacific.

From the seas around the Cape of Good Hope has been obtained a small dolphin belonging to the family *Delphinidæ*, characterised by the bold contrast of black and white in its colouring, and thus recalling the much larger grampus, or killer. This dolphin, which represents a genus by itself, is known as *Cephalorhynchus heavisidei*. During the *Discovery* expedition an apparently undescribed dolphin, remarkable for its peculiar type of colouring, was observed in the neighbourhood of the Antarctic ice. It attains an apparent length of from 8 to 10 feet, and may be described as a chocolate-brown dolphin, with two large patches of white occupying the greater portion of each side of the body. Posteriorly the two hind patches are united by a narrow isthmus of white across the upper surface of the base of the tail, while the two patches on each side are sundered from one another only by a narrow strip of chocolate, descending from the base of the back-fin to join the brown of the belly. The nearest approximation to this style of colouring is presented by certain dolphins of the genus *Lagenorhynchus*, and more especially by *L. cruciger*, but the dark under-parts appear peculiar to the Antarctic species.

Perhaps, however, the most noteworthy of the smaller cetaceans is the La Plata dolphin (*Pontoporia*, or *Stenodelphis, blainvillei*), of the estuary of the Rio de la Plata and the bay of Monte Video. This is a long-beaked species, of between 4 and 5 feet in length, and of a uniformly light brown colour, somewhat darker on the back than beneath; this colouring being in harmony with the muddy water of the La Plata river. This dolphin is related to the inia (*Inia geoffroyensis*) of the Amazons, with which it constitutes the family *Iniidæ*; a more distant relative being the susu (*Platanista gangetica*) of the larger Indian rivers, referred to in the second volume.



THE WRY-BILL.

Wry-Bill. Among the birds of the Antarctic, one of the most remarkable is the wry-bill (*Anarhynchus frontalis*), a member of the plover tribe inhabiting the coasts of New Zealand. The unique feature of this species is that the beak is strongly curved to the right side, apparently for the purpose of enabling the bird to pick up insects and crustaceans from under plant-stems, around which it invariably walks from left to right. In colour the wry-bill is grey, with white under-parts, and a black collar, broader on the left than on the right side, round the neck. Although bilateral asymmetry is extremely rare among vertebrated animals, it occurs in the skulls of dolphins and all the other cetaceans furnished with teeth, in the internal ear of certain owls, and, most markedly, in the male narwhal of the Arctic, which normally has but one properly developed tusk.

Sheath-Bills.

Intermediate in certain respects between the plover and the gull tribes are the exclusively Antarctic birds known as sheath-bills, or kelp-pigeons, one of which (*Chionis alba*) was discovered by Captain Cook on New Year Island, and has been subsequently observed on many other islands to the south of the Strait of Magellan, while the second species, *C. minor*, the lesser sheath-bill, inhabits the Crozets and Kerguelen Island. In appearance these sheath-bills resemble white pigeons; the beak in the larger species being yellow and pink, with the sheath flattened, while in the smaller kind it is black with the sheath curved. On Kerguelen, where they abound, these birds feed chiefly on penguin eggs; but they also consume carrion and vegetable substances. They lay, in a rude nest of grass placed among rocks, two large, dull, greyish blue eggs spotted with dark reddish brown and violet, from which in due course are hatched the wholly black chicks.

Antarctic Skua.

The Antarctic skua, or sea-hen (*Megalestris antarctica*), which equals the great skua of northern Europe in point of size, and also resembles that bird in its predatory mode of life, is sooty brown in colour, both above and beneath.

Albatroses.

Largest of all sea-birds is the wandering albatros (*Diomedia exulans*), in which the expanse of wing reaches to as much as 10 feet, although the weight of the whole bird may not exceed 17 lb. This magnificent species—of which the plumage is pure creamy white with black wings—seldom ranges much to the north of 35° S. latitude, and breeds on the Auckland and other islands in the far south. The smaller black-eyed albatros (*D. melanophrys*), characterised by the presence of a black band on each side of the eye, as well as by the dark grey wings and paler grey tail, is, however, the species to which the epithet "wandering" is really more appropriate, since it may frequently be seen so far north of the equator as California, and may even occasionally straggle to the British islands. The name albatros, it may be mentioned, has a distinctly curious origin, being a corruption of the Spanish and Portuguese *alcatraz*, or *alcaduz*, which is commonly applied to the pelican, as well as to other large birds, and is itself a derivative from the Arabic *al-cadous*, which is again derived from *kados*, the Greek term for a water-pot or bucket, and more especially the leather bucket of an old-fashioned irrigating machine, such as those still in use on the Nile. The transference of the name to the pelican, which was supposed to carry water to its young in the great pouch of skin attached to the lower half of the beak, is perfectly easy to understand. The generic name *Diomedia*, meaning the bird of Diomedes, and the equivalent of Pliny's *Avis Diomedeæ*, appears to belong of right to a species of shearwater inhabiting certain Mediterranean islands. But the misapplication of names in connection with these birds does not end here, for the name "mollymauk," applied by sailors to the yellow-beaked albatros (*D. culminata*), of Tristan da Cunha and other southern islands, appears to have been originally the designation of one of the species of the northern fulmars.

In the nesting-season many of the islands in the Pacific, especially Laysan Island, and others in the southern ocean, such as Tristan da Cunha, are the resort of thousands of albatroses; and the following account of the breeding-colonies of these birds is given in that delightful book, *A Naturalist on the Challenger.* "They make," it is there written, "a cylindrical nest of tufts of grass, clay, and sedge, which stands up from the ground. The nest is neat and round. There is a shallow concavity on the top for the bird to sit on, and the edge overhangs somewhat, the old birds undermining it during incubation by pecking away the turf of which it is made. One nest was 14 inches in diameter and 10 inches in height. The nests when deserted and grass-grown make most convenient seats. The birds lay a single egg, about the size of a goose's or somewhat larger, but elongate, with one end larger than the other, as are all albatros eggs. The egg is held in a sort of pouch whilst the bird is incubating. The bird has thus to be driven right off the nest before the egg is dropped out of the pouch and it can be ascertained whether there is one there or no. The birds when approached sit quietly on their nests or stand by them, and never attempt to fly; indeed they seem, when thus bent on nesting, to have forgotten almost the use of their wings. Captain Carmichael, in his account of Tristan da Cunha, relates how he threw one of the birds over a cliff and saw it fall like a stone without attempting to flap, and yet these birds will soar after a ship over the sea as cleverly as any other albatros; indeed the same peculiarity occurs in the case of the large albatros when nesting."

Petrels.

Petrels, or tube-nosed sea-birds, attain a great development in the Southern Hemisphere, where two of their best-known representatives are the so-called Cape pigeon (*Daption capensis*) and the dove-petrels of the genus *Prion*, the latter characterised by the rows of fringe-like plates on the boat-shaped beak. The range of the Cape pigeon extends as far north as Ceylon and Peru. Another well-known species, widely distributed in the southern seas, but breeding as far north as Madeira and the Cape Verde Islands, is the white-faced or frigate petrel (*Pelagodroma marina*). In Australia this bird is known as the storm-petrel, while it has also usurped the title of Mother Carey's chicken, although both these names belong to *Procellaria pelagica*, of the Northern Hemisphere. These petrels form enormous colonies; and the following account refers to a visit to one such colony made at Christmas during the breeding-season, when it was estimated that there were at least 50,000 nesting-burrows on the spit. The site of each burrow is marked by a little heap of sand at the entrance; and in some places these burrows, which are sheltered by sea-plants of two kinds, are so numerous that on an average there is one to every square yard of ground. They are just wide enough to contain the hand, and of such a length that the terminal nesting-chamber can be easily reached. The sitting petrel can thus be readily captured; and in all cases during the day only one bird is to be found in each burrow, its mate being away fishing at sea. Late at night the absentees begin to return and relieve their mates at the duty of incubation. By marking a certain number of birds found sitting in the daytime it was ascertained that

ALBATROSS.

only a small proportion were relieved of their duties during that night, thus indicating that the sitting bird must go for four or five consecutive days at a time without tasting food. In February young petrels may be found in various stages of development, some still in the downy state, but others well feathered. Till able to fish for themselves the young petrels are fed every night with about a teaspoonful of oily paste, principally compounded from the minute crustaceans known to sailors as 'whale-food.' This is regurgitated by the old birds as they enter the burrows, where they are welcomed with a purring note by their offspring. On arrival the parent bird opens its beak to the fullest extent over the head of the nestling, which in turn thrusts its own open beak into the parental mouth or gullet, there to receive the regurgitated food.

Another common but much larger petrel is the so-called mutton-bird (*Puffinus brevicauda*), which breeds in thousands on the coasts of Australia and New Zealand, and derives its vernacular name from its reputed excellence as a table-bird. Petrels and their relatives are probably attracted to such southerly regions by the extraordinary abundance of food to be found immediately north of the ice-barrier, some of these visitors making their appearance in autumn after the breeding-season, while others may be non-breeding birds which spend the whole summer in the South Antarctic. That the Arctic tern, after breeding in the Far North, should visit the opposite pole is a most remarkable fact in geographical distribution.

In many respects the diving-petrels of the genus *Pelecanoides* differ from their kindred and approximate to auks in general appearance when seen from a distance, although they conform to the true petrel type in all essential points of structure. The best known of the three species frequenting the New Zealand coasts is *P. urinatrix*, which is blackish grey above and white beneath.

Penguins.

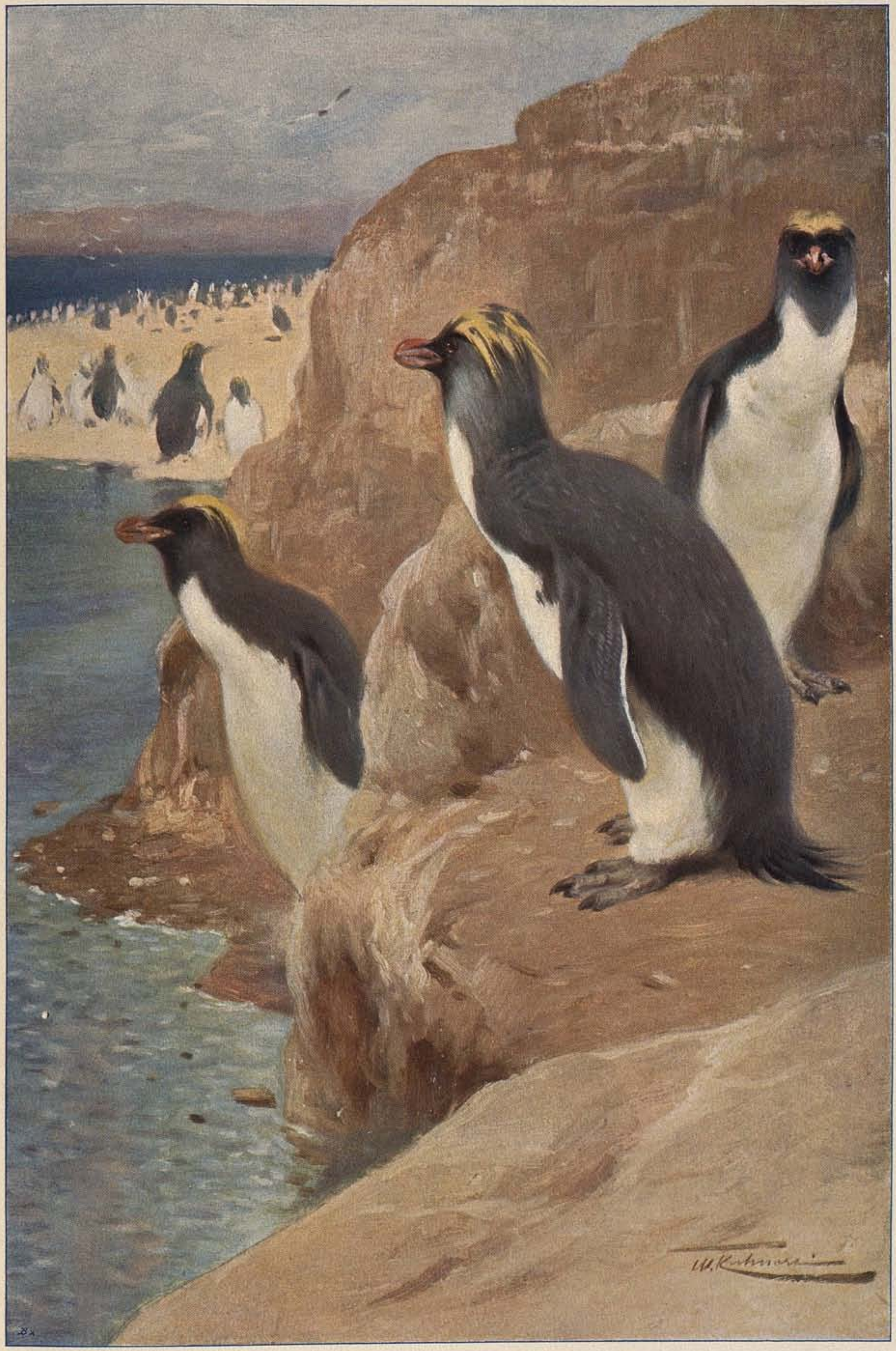
By far the most remarkable and characteristic group of birds inhabiting the Antarctic are those now universally known as penguins, although properly speaking the name penguin belongs to the extinct great auk of the Northern Hemisphere. Penguins, which form by themselves a separate order of birds, are an exclusively southern group, members of which swarm on the Antarctic pack-ice and also frequent the shores of the southern islands and continents. They have no near relatives among either recent or extinct birds, and differ from all other birds in the structure of their wings and feet, the former of which act as paddles in swimming, and are quite useless for flight. So far as can be determined, penguins appear to have always had their headquarters in the Antarctic, to which some of the species are restricted. They breed on the Pacific coast of South America from Peru to Patagonia and the Falklands, as well as on the coasts of South Africa, Australia, New Zealand, and nearly all the islands of the Antarctic, and likewise on the Antarctic continent itself.

The penguin family, *Spheniscidæ*, is divisible into several distinct generic groups, among which the short-tailed penguins of the genus *Spheniscus* range farthest north. Of this group a well-known representative is the black-footed penguin (*S. demersus*) of South Africa, which is about twenty inches in height when standing erect. Like other penguins, these birds dart along under water with extraordinary rapidity, propelling themselves by their scaly, oar-like, rudimentary wings, and steering with their legs and feet. On the surface, however, they swim more slowly, holding the body horizontally, with the head well raised. When on shore—to reach which the aid of beak, wings, and feet is employed—their movements are very awkward, and as they lie basking in the sun they look almost like small seals, more especially when their feet are extended backwards. The young birds are bluish grey above and white below, but later the colour changes to brown on the middle of the head, the nape of the neck, back, and throat, while a broad white stripe makes its appearance on each side of the head, and a narrower band of brown forms a curved belt across the chest, whence it gradually expands on the flanks, to contract again in width as it nears the legs. Nearly allied is Humboldt's penguin (*S. humboldti*), which breeds on the western coast of South America, and is a slightly larger bird, distinguished by the narrower stripe on the side of the head, and the broader band across the chest.

A second group is formed by the crested or so-called rock-hopper penguin (*Eudyptes chrysocome*). These maccaroni penguins, as they are sometimes called, are easily recognised by the plume of golden bristly feathers on each side of the crown of the head. They stand about twenty inches in height, and breed in vast numbers on the Falklands. An interesting fact in connection with the rock-hoppers on those islands is that the smooth surfaces of the hard igneous rocks over which myriads of these penguins have been constantly passing and repassing for centuries are not only highly polished, but are also scored by irregular grooves cut by the sharp claws of these birds. A striking feature in these "rookeries" of penguins is the number of maimed and dying birds to be met with; these having, for the most part at any rate, been injured by sea-lions.

Largest of all is the splendid emperor penguin (*Aptenodytes forsteri*), which stands nearly three and a half feet in height, and has the beak unusually long and slender, but no crest. This magnificent bird is a native of Victoria-land, and breeds farther south than any other member of the family, except perhaps the much smaller Adelia penguin, referred to below. The most extraordinary thing about the emperor penguin is that the females breed in the depth of the Antarctic winter on the pack-ice, where each bird holds its single egg on its feet, where it is incubated by the heat of the lower part of the body of the parent. Should the egg come even in momentary contact with the ice, it immediately freezes and splits, thereby rendering nugatory the cold vigil of the parent bird.

Another genus is represented by the much smaller Adelia penguin (*Pygoscelis adeliæ*), which, unlike the emperor penguin, is a migratory species, met with in vast rookeries during the breeding-season at Cape Adare and other favourite spots. Despite their migratory habits, these penguins never travel far north of the Antarctic circle. They return from their winter sojourn on the pack-ice to the land of the Antarctic continent from September to November, when thousands of them may be seen waddling to and fro between the shore and the water: the new arrivals sordid and dirty, while those returning look as smart and neat as the proverbial new pin. At such times thousands of the Adelias may be seen standing on the edge of the ice preparatory to plunging into the water, which appears to be a matter demanding a considerable amount of consideration. When,



ROCK PENGUIN.

however, one bird makes a start, the rest soon follow; and when once in the water they disport themselves like dolphins, for which they might easily be mistaken. When tired of such sports, they return to the ice, from which they can be driven only with difficulty.

The Adelia penguin takes its name from Adelie-land, where it was discovered in the year 1841; but it appears to range completely round the southern pole, its northern limit being formed approximately by 60° S. latitude. In disposition these birds display remarkable curiosity, coming to inspect any object that appears strange to them. In doing so they advance in an irregular manner, turning to the right or left in succession, until they finally reach the person or object which has attracted their attention, when they halt and make a thorough inspection, uttering low, plaintive cries, and slowly moving their paddle-like wings. When undisturbed and on level ground, they walk on their feet in a vertical position with their heads stretched forwards, and their wings either slightly expanded or hanging limply down their sides. But when frightened or in a hurry, they fall on their bellies and push themselves along in that position by their legs, somewhat after the fashion of the divers. In making an ascent, both wings and legs are made use of, but in descending a slope these birds allow themselves simply to slide down, merely using their wings to aid in maintaining their balance. If pursued while making such a descent, they move so swiftly that it is difficult to catch them. They feed chiefly on the minute crustaceans of the genus *Euphausia* which swarm on the borders of the pack-ice. The breeding-season commences rather before the middle of November, when the females lay two, or rarely three, eggs, which are incubated in turns by both sexes. If the first clutch be removed, the female will generally lay two or three more, but these are small, and may be devoid of yolks. When they are approached, the sitting birds do not forsake their charge, but content themselves with pecking and hissing at the intruders. As there may be something like three thousand birds in a colony, these eggs afford a welcome supply of food to explorers who have braved the hardships and privations of the long Antarctic winter.

In the Falklands the Adelia penguin is replaced by the gentu penguin (*P. tæniata*). In several districts penguins are slaughtered wholesale for the sake of their oil. As regards the Antarctic species, which were at that time unmolested, the naturalist to the *Discovery* expedition was of opinion that the emperor penguin is secure from attack during the breeding-season, although at other times of the year its destruction could be encompassed, as could that of the Adelia penguin at all seasons.

According to a report on the remains of extinct fossil Vertebrata obtained during the Swedish Antarctic expedition at Seymour Island, in the South Shetland group, the living emperor penguin is a mere dwarf in comparison with its early Tertiary predecessors. One of these, *Anthropornis nordenskioldi*, stood apparently about six feet in height; while a species (*Palæeudyptes antarcticus*) described many years previously from early Tertiary strata in New Zealand was probably at least five feet in height. Still more interesting is the fact that the Seymour Island giant penguin possessed wings of far greater relative length and of a less modified type than those of its existing descendants; very similar conditions also occurring in certain fossil penguins (*Palæospheniscus* and *Paraptenodytes*) from strata of later Tertiary age in Patagonia. Yet more important is the greater relative length and slenderness of the shank-bone of the leg in the Seymour Island penguin as compared with its modern representatives, in which this portion of the skeleton differs remarkably from that of all other birds. The three elements of which this bone is composed are also more completely welded together than in living penguins. This points to the conclusion that penguins are descended from birds endowed with the power of flight, the shortening and expansion of the shank-bones being due to the lack of active use of the hind-limbs, which are required merely as firm bases of support, and as a rudder in swimming. The nearest relatives of penguins are apparently divers and petrels.

THE DUGONG.

CHAPTER II

The Indo-Pacific and its Shores

Dugongs. THE marine mammals of the Indian Ocean and the warmer zones of the Pacific include a characteristic species of sea-cow, or sirenian, universally known by its Malay name of dugong, a name also employed in its scientific designation, *Halicore dugong*. These sea-cows frequent the coasts of the Indian Ocean from East Africa on the one side to northern Australia on the other. In colour dugongs are either uniformly grey or greyish black above and whitish beneath; while in length they may grow to as much as eight or nine feet, although they are usually rather smaller. Among the characteristics of dugongs, of which there appears to be but one species, may be mentioned the position of the nostrils on the upper surface of the muzzle, the oval, nailless flippers, the convex horizontal and oval tail, the presence of a pair of large tusks in the upper jaw of the males, and the simple, semicylindrical structure of the few pairs of cheek-teeth, which are quite unlike the numerous series of ridged molars found in the manati.

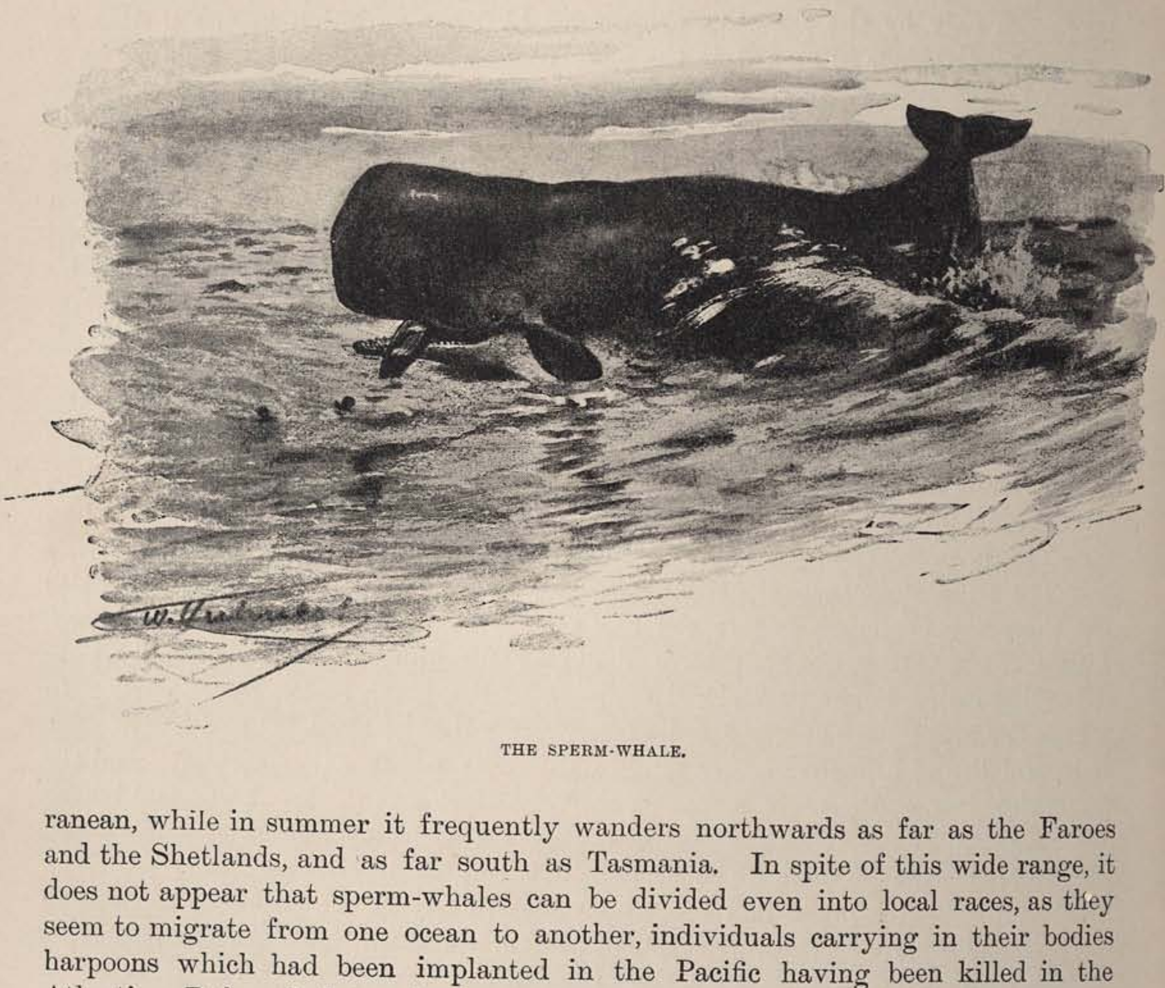
In former days dugongs are reported to have occurred in large herds, and to have been so confiding that they might without difficulty be touched with the hand. For the sake, however, of their flesh, which is stated to be of excellent quality, and their valuable oil, they have been so persistently hunted that they have everywhere become more or less scarce. Dugongs are sluggish, harmless animals, never ascending rivers to any considerable distance, but frequenting still, shallow bays and estuaries, where they browse on marine vegetation, especially a green alga and a certain phanerogamous plant. Their method of feeding is not the same as in manatis, which pluck the plants, they eat by means of the two fleshy lobes above the upper jaw-pad, and push their food towards the mouth with the flippers. Similar lobes certainly exist in the dugong, but these do not appear in fresh specimens to be capable of any great degree of separation or movement, while the flippers are hardly long enough to give any assistance in feeding. On the other hand, as the upper jaw-pad, or upper lip, itself is evidently freely movable, and possibly to some extent extensile, it seems possible that it is used in plucking seaweed, which certainly could be grasped between the pad and the lower jaw. In India and Ceylon the fishermen report that a single young one may be seen with a female at any time of the year; but on no occasion have they observed a female nursing its offspring with one of her flippers, while her head and fore-part of her body are raised out of the water after the fashion supposed to have given origin to the mermaid-myth. Nevertheless it is generally believed that the dugong, and not the manati, has given rise to this old legend.

In Australia, dugongs now stand in imminent danger of extermination owing to the relentless pursuit of the females, which yield more oil than the males. For some time this was largely used in place of cod-liver oil for lung and nerve troubles, but it has recently fallen somewhat into disfavour, owing to adulteration with shark-oil. One of the native methods of killing dugongs is to erect a staging near the mud-flats to which these animals resort to browse on seaweed. On this stage two or three men, armed with a coil of rope and harpoon, take up their station on a moonlight night; the harpoon consisting of a long pole with a hollow at one end, into which is fitted a wooden head, attached to the side of the pole by a grass-rope. Directly a dugong appears, it is struck with the harpoon, when it immediately rushes off; but the pole attached to the harpoon-head by the rope greatly retards its progress, and enables the natives, who at once take to a canoe, to come up and dispatch the victim when it is exhausted. Another method is to spear the dugongs from a canoe in the daytime as they are making their way to their feeding-grounds; the weapon employed in this case being a light spear tipped with a piece of sharpened fencing-wire. The wire bends in the gutta-percha-like hide, and the shaft so hampers the movements of the animal that it is easily caught up by the canoe. The wound inflicted is, however, not mortal, and as the natives do not appear to have any more efficient weapon, they resort to the expedient of drowning the unfortunate creature. Europeans adopt a third method. An enormous wide-meshed net, over a mile in length, is set when the tide is out along the outside of the mud-banks where the sea-grass grows, and supported by stout stakes. As the dugongs come in to feed on the flood-tide, they pass over the top of the net, but when about to return with the ebb find their path barred. Swimming up and down the inner line of the net, the dugongs (often, it may be, but one) become thoroughly frightened, and at length, in desperation, drive their heads through the meshes of the net, when their fate is sealed, as they become inextricably entangled in it, and are finally drowned.

Whales and Dolphins. As reference already has been made to the southern black whale, or southern right-whale (*Balæna australis*), both in the preceding chapter and in the one on the fauna of the Atlantic, it will suffice to add that an allied species or race, *B. japonica*, inhabits the North Pacific. Rorquals are represented in the Indian Ocean by a larger and a smaller kind which have been respectively named *Balænoptera indica* and *B. edeni*; but it is very doubtful whether they are anything more than local races of two of the large European species. The lesser rorqual (*B. rostrata*, or *B. acuti-rostrata*), the smallest representative of the group, likewise appears to have an eastern representative. In its typical European form this whale differs from all its relatives by the presence of a broad white band round each flipper; but as most of its foreign representatives are known only by the skeleton, there may be local variation in the matter of colouring. Evidence in regard to the wide range of this species is furnished by a skeleton from Borneo, received a few years ago at the British Museum, which agrees in all respects with European examples. From the southern part of the opposite hemisphere, namely, the estuary of the Rio de la Plata, rorquals of this species have been described under the name of *B. rostrata bonariensis*. From South America the species probably extends to New Zealand, where it is represented by *B. r. huttoni*. In the North Pacific we find a race described years ago by Scammon under the name of *B. r. davidsoni*. In most, if not all, cases the above-mentioned foreign representatives of the species are known only by the skeleton, but a fin-whale from some part of the Atlantic has been named *B. r. racovitzai*, and is stated to be characterised by the presence of a brilliant white streak on the upper jaw in addition to the band round the flipper. This whale is likewise stated to differ from the typical *rostrata* by feeding on minute invertebrates and diatoms ('plankton') instead of on fish. Nevertheless, it is regarded as nothing more than a race of the ordinary species.

The humpbacked whale (*Megaptera boöps* or *M. nodosa*) is, as mentioned in the preceding chapter, allied to the rorquals, but distinguished by the excessive length of the flippers, which have scalloped margins, and are generally pure glistening white, forming a marked contrast to the black of the upper-parts. In length the flippers are nearly equal to one-fourth that of the head and body. The chin and throat are grooved, forming a dilatable pouch, as in rorquals, and the back-fin is low, and the whole shape relatively short and thick. The usual length attained by humpbacks ranges between forty-five and fifty feet; the female being superior in size to the male. The whalebone is comparatively short, and deep black in colour. Humpbacks, which are widely distributed in the Atlantic and Pacific Oceans, and also met with in the Indian Ocean, are remarkable for their sportive habits, frequently throwing themselves clear of the waves, and sometimes lying on one side just below the surface, with one flipper rising vertically out of the water. On the African side of the Indian Ocean it was for some years observed that between May and August large numbers of humpbacked whales passed between Natal and the Delagoa Bay coast, and in May 1908 the Norwegians obtained permission to establish a whaling-station on the Bluff side of the channel, where between July and the early part of September no less than one hundred and two humpbacks and two hundred rorquals were taken. This, however, by no means exhausted the supply, as a naturalist subsequently described his experience of steaming into the midst of a 'school' of about a score of these monsters, the movements and gambols of which afforded a wonderful spectacle. Nevertheless, such vigorous hunting cannot long be carried on without seriously diminishing the numbers of the whales.

Highly characteristic of the Indo-Pacific is the cachalot, or sperm-whale (*Physeter macrocephalus*), which is much the largest member of the whales furnished with teeth, rivalling in this respect the larger whalebone whales, although of very different bodily shape and proportions. Not that this gigantic cetacean is by any means restricted to the Indo-Pacific. On the contrary, it inhabits all the seas of the tropical and subtropical zones, inclusive of the Mediterranean, while in summer it frequently wanders northwards as far as the Faroes and the Shetlands, and as far south as Tasmania. In spite of this wide range, it does not appear that sperm-whales can be divided even into local races, as they seem to migrate from one ocean to another, individuals carrying in their bodies harpoons which had been implanted in the Pacific having been killed in the Atlantic. Before their numbers were so greatly diminished by incessant hunting, it is quite probable that old male cachalots may have attained considerably larger dimensions than any of those killed in recent years. Even now, however, adult bulls of nearly sixty feet in length are sometimes taken. The more slenderly built cows are much smaller, seldom exceeding a little more than half the dimensions of the males. In old bulls the abruptly truncated and squared head is of enormous size, occupying nearly one-third the entire length of the animal. In a cavity of the skull, bounded behind and at the sides by a huge semicircular wall of bone, is



THE SPERM-WHALE.

contained the valuable substance known as spermaceti, which, although liquid in the living animal, assumes the solid state after death. The 'blow-hole,' or nostril, which is shaped like the sound-aperture of a violin, is situated on the top of the extremity of the muzzle—a unique position among cetaceans—somewhat to one side of the middle line. The relatively small eyes are situated a little distance above the angle of the mouth, and the apertures of the ears form minute punctures in the skin a short distance behind the eyes. Although a back-fin is wanting, a series of irregular protuberances or humps occupies the middle line of the hind part of the back; the largest of these being the one in front, which is the portion first to become visible when the whale rises from the water in order to breathe. The inside of the mouth and the huge tongue are dazzling white; and so is the throat, which, unlike that of the Greenland whale, is of enormous capacity. The food of the cachalot, which is obtained, in many instances at any rate, at very considerable depths, consists mainly of gigantic cuttle-fishes and squids. The huge size of these cephalopods may be estimated from the fact that wounded cachalots have been known to disgorge great 'chunks' of the arms of cuttle-fishes measuring, roughly speaking, about six by six by eight feet. The diet of these whales is, however, by no means restricted to food of this kind, since they also consume a considerable number of surface-swimming fishes, more especially albacore and bonito.

In this place a short digression may be made on the subject of the depth to which whales are capable of diving, or 'sounding,' as it is called by whalers. Formerly the belief obtained among both whalers and naturalists that when whales 'sound' they descend to enormous depths. One naturalist has estimated, for instance, that the larger members of the group commonly dive to a depth of at least a thousand yards, although the evidence on which this estimate rests is not given. On the other hand, the naturalist to the Belgian Antarctic Expedition of 1897–99 has challenged this belief, and stated that, in his opinion, a hundred yards is the maximum depth to which any whale can dive, and that many of them cannot reach even anything like that limit. Why, indeed, it is asked, should whales want to go to such depths? All the species sound for the purpose of obtaining food; and in the profound darkness of a thousand yards they would be unable to find food in most instances, although those which feed on animalcules might perhaps obtain what they want. In regard to the species which feed on fishes and cuttles, at a depth of a thousand yards they could not use their eyes to detect non-luminous species, and there is no evidence that they feed on the self-luminous deep-sea fish and cuttles, if there be any of the latter. On the contrary, the available evidence indicates that they feed on ordinary light-dwelling fishes and cuttles which live in much shallower zones. Moreover, it is known that the effects of a pressure of more than three atmospheres prove fatal to human life, and although it may be urged that whales can stand treble this pressure, or nine atmospheres, which would occur at about ninety yards depth, it is inconceivable that they could resist the effect of ten times the latter pressure, or ninety atmospheres. Again, it seems impossible that a whale, whose body is only slightly heavier than water at ordinary pressure, could exert the muscular force necessary to propel that body to a depth of a thousand yards. Whether the same naturalist has so strong a case in his contention that whales never sleep, must await further consideration.

One of the arguments in favour of the constant wakefulness of cetaceans, is that individuals will follow a ship for days, which they could not well do while asleep. Another is that whales—except occasionally a right-whale or a sperm-whale—are not found floating motionless on the surface, and reasons are given against the theory that they sleep at the bottom. It may, however, be urged that if whales never sleep, they must have food at night, and be able to catch it, and what then becomes of the argument that they cannot capture prey in the dark ocean abysses? Further, it is difficult to imagine that an animal with such a highly organised brain as a whale can exist without ever sleeping, especially when it is remembered that fishes sleep.

Returning to the cachalot, it may be mentioned that although far less numerous at the present day than it was half or three-quarters of a century ago, 'schools' of considerable size are still from time to time to be met with. Decisive evidence of this is afforded by the fact that in the early part of 1910 no less than thirty-seven sperm-whales, of which thirty-six were males, averaging about fifty feet in length, were stranded on Perkins Island, Tasmania, the carcases of all of which were utilised for commercial purposes. The occurrence was at the time regarded as unprecedented, but there is a record that in the year 1723 seventeen sperm-whales were stranded at the mouth of the Elbe, and also that a much larger number were driven ashore in the Bay of Audierne, in the Department of Finistère, France, on 14th March 1784. On the latter occasion the number of stranded individuals was thirty-two, and as each came within reach of the breakers it is recorded that it was rolled helplessly over and over, and eventually thrown on the shore.

In addition to the oil from its blubber, the two most valuable products of the sperm-whale are spermaceti and ambergris, the nature and location of the former of which have been already mentioned. Both spermaceti (as we know it) and ambergris have long been known to be the products of whales, although there was formerly an idea that at least one of them was obtained from the Greenland whale instead of both of them being yielded chiefly by the cachalot. The spermaceti of the older naturalists, such as Olaus Magnus, Conrad Gesner, and other European writers of the fifteenth and sixteenth centuries—by whom it is alluded to as ambar—seems, however, to have been ambergris, as it is described as being of a greyish colour and found floating on the surface of the sea; in both of which respects it agrees with what we now call ambergris rather than spermaceti. And it may be added that from its physical structure, ambergris rather than spermaceti, is much more likely to have been regarded as cetacean sperm. Such amounts of real spermaceti as were obtained previous to about the year 1700 were not improbably the products of sperm-whales stranded on the coasts of the Mediterranean, as the Italians have from early times called this whale *capidoleo, i.e.* 'oil-head,' and were thus evidently familiar with the fact that the cavity of the skull contains the oily liquid which solidifies after death into what we call spermaceti. On the other hand, sperm-whales are but rarely stranded on the British coasts, and the testimony of the old Norfolk naturalist Sir Thomas Browne tells us that such carcases were expected to contain ambergris in the stomach, but makes no mention of spermaceti. It accordingly appears that for a long period there was great confusion between spermaceti and ambergris; one being often called white amber, while the other was invariably designated by a term equivalent to grey amber. Which was the original *spermaceti* still remains to be proved.

In regard to what we now call ambergris, it may be mentioned that although in former days this was extensively employed in medicine, it is now used only in perfumery. It is solely a product of the sperm-whale, and appears to be a kind of biliary calculus, and generally contains a number of the horny beaks of the cuttle-fishes and squids, upon which the whales have fed. Its market-price is subject to considerable variation, but from £3 to £4 per ounce is the usual average for samples of good quality. In 1898 a merchant in Mincing Lane was the fortunate owner of a lump of ambergris weighing 270 lb., which was sold in Paris for about 85s. per ounce, or £18,360. In regard to the origin of the name, it appears, from an article by an American naturalist, that *ambar* (*i.e.* the creature moving in the waters) is the Arabic name of the sperm-whale; and hence we have 'grey-ambar,' or 'ambergris,' as the designation of the grey aromatic substance yielded by this species, while the other product, the glistening white spermaceti, is known as 'white ambar,' or 'amberblanc.' In the Ethiopic Bible, *anbar*, another form of *ambar*, is used for Jonah's whale; and this suggests that sperm-whales were formerly common in the Mediterranean, where they are now comparatively scarce. This is confirmed by the fact that sperm-whales are mentioned, under the name of *nâkhiru* (*i.e.* 'blower,' equivalent to the Greek *physeter*, which has the same meaning), in Assyrian cuneiform inscriptions, dating from between 885 and 860 B.C. The author of this derivation is thus led to conclude that Jonah's whale was a sperm-whale. He also points out that there appears to be some connection between the scriptural narrative of Jonah and the classic legend of Andromeda and the sea-monster; and that in ancient times the skeleton of a sperm-whale (believed to be the sea-monster in question) is stated to have been fastened by chains to the rocks at the entrance to one of the harbours at the eastern end of the Mediterranean.

In addition to the true, or great, cachalot, the Indian Ocean, and probably also the tropical Pacific, is inhabited by the much smaller species known as the lesser sperm-whale (*Cogia breviceps*), which, like its giant cousin, constitutes a genus by itself. Cuvier's beaked whale (*Ziphius cuvieri*) is also probably an inhabitant of the Indo-Pacific, as is certainly the case with its cousin, Layard's beaked whale (*Mesoplodon layardi*), to which reference has already been made in the preceding chapter.

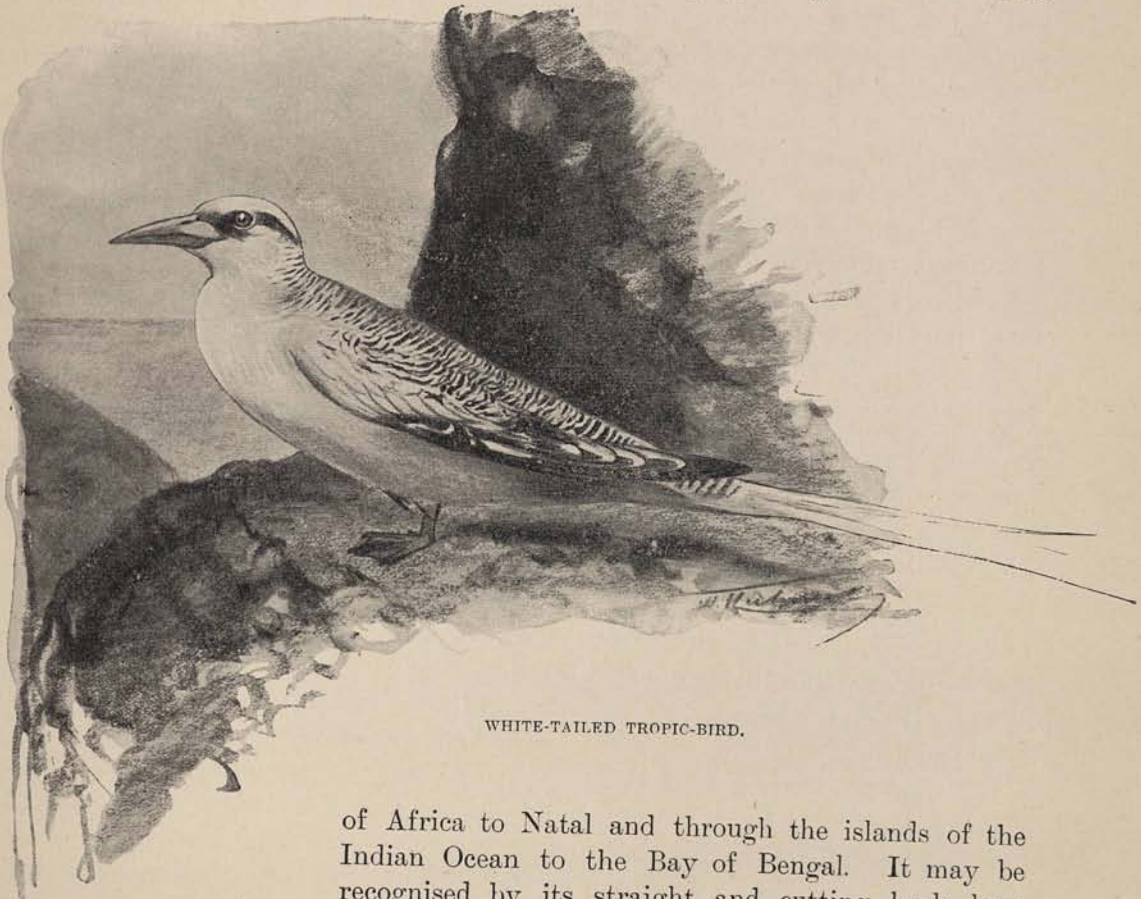
The same remark applies also in the case of Heaviside's dolphin (*Cephalorhynchus heavisidei*). On the other hand, the Indian porpoise (*Neomeris*, or *Neophocœna, phocœnoides*) is a characteristic cetacean of the Indo-Pacific, where it frequents the neighbourhood of islands, and ranges from the Cape to Japan. This porpoise, which grows to a length of about four feet, is specially characterised by the absence of a back-fin, as well as by the presence of a patch of small bony tubercles on the middle of the back; these tubercles, or scales, being not improbably the last remnants of a bony panoply in which there is good reason to believe the bodies of certain extinct whale-like animals were invested.

Another characteristic southern type of cetacean is formed by the Irawadi dolphin (*Orcella fluminalis*) and its near relative *O. brevirostris* of the Bay of Bengal. The Irawadi species, which ascends a long distance up the river from which it takes its name, grows to about seven feet in length and is slaty grey or almost black above and but little lighter below. With a somewhat globular head and a small, sickle-shaped back-fin, this species is furnished with a comparatively small number of minute, sharp teeth, spaced out so as to occupy nearly the whole length of the jaws. Among other cetaceans, a local race of the black-fish (*Globiocephalus melas indicus*), said to be distinguished from the typical European representative of its species by its uniformly bluish grey colour and less numerous teeth, frequents the mouth of the Ganges; while the wholly black false killer (*Pseudorca crassidens*) has been taken off Travancore and Tasmania. Several kinds of dolphins belonging to the bottle-nosed group, such as *Tursiops catalania*, abound off the Travancore coast; and there are likewise numerous long-snouted dolphins of the genera *Steno* and *Sotalia*, such as Elliot's dolphin (*Steno perniger*), the spotted dolphin (*Sotalia lentiginosa*), the pale grey Bornean *S. borneënsis*, and the white Chinese dolphin (*S. sinensis*), with its flesh-coloured flippers, to be met with in the Indo-Malay and Chinese seas.

Laysan Finch. Turning to the birds which frequent the islands and shores of the Indo-Pacific, attention may be directed in the first place, on account of its remarkable habits, to a member of the finch tribe, *Telespiza cantans*, inhabiting the small coral-island of Laysan, lying to the west-north-west of the Hawaiian group, somewhat to the northward of the Tropic of Capricorn. The peculiarity connected with this species is that its food is almost wholly of an animal nature, consisting to a great degree of the eggs of the sea-birds which resort to the same island. The eggs are broken by a few blows from the strong, sharp beaks of these finches; and the audacity of these birds in searching for their favourite food is so great that other birds, when sitting, dare not leave their nests for a moment. The sea-birds have, however, learnt great caution in the matter of incubating, and when one of the sitting hens is about to be relieved by her mate as he returns from a flight out to sea, she sits close until actually pushed off her nest, so that the eggs are not even momentarily exposed. In spite of such precautions, the finches are, however, not infrequently successful in their raids, and carry off one or more of the eggs. In colour the Laysan finch is brown, with a greenish head and yellowish under-parts. It is so fearless of man that it even alights on a dinner-table, and pecks at the viands on the plates and dishes.

Laysan Rail. Laysan Island is likewise the home of a peculiar species of small rail (*Porzanula palmeri*), which, unlike its relatives, feeds partly on insects, but mainly on the eggs of the sea-birds. Having, however, a beak too feeble to break the eggs for itself, it shares the plunder of the finch. As audacious and importunate towards man as the latter, this rail is unable to fly, although it makes use of its stumpy wings to increase its speed when running along sandy shores.

Stilt and Plover. Those typical frequenters of the shore and the lagoon, the stilts, are characterised by the slender, straight beak, the absence of a hind-toe, the very small web connecting the toes, and, above all, by their elongated legs. Among them, the black-winged stilt (*Himantopus candidus*) takes its name from the black and white plumage, but is further distinguished by the bright red legs and jet-black beak. These birds, of which the range extends from the West African coast to the Cape of Good Hope, breed in the islands of the Mediterranean, South Africa, north-western India, and the valley of the Hoang-ho, as well as in many intermediate localities, and as stragglers visit the British Isles and other parts of northern Europe. Their food consists of the insects and crustaceans to be met with in or on shallow water, in search of which these birds wade knee-deep for hours; their favourite haunts being muddy shores. The crab-plover (*Dromas ardeola*), on the other hand, selects sandy beaches, ranging along the eastern coast of Africa to Natal and through the islands of the Indian Ocean to the Bay of Bengal. It may be recognised by its straight and cutting beak, long legs, and comb-like middle toe. The single large white egg is laid in a sand-burrow. In colour this bird is white with black wings, beak, and feet, and a grey tail.

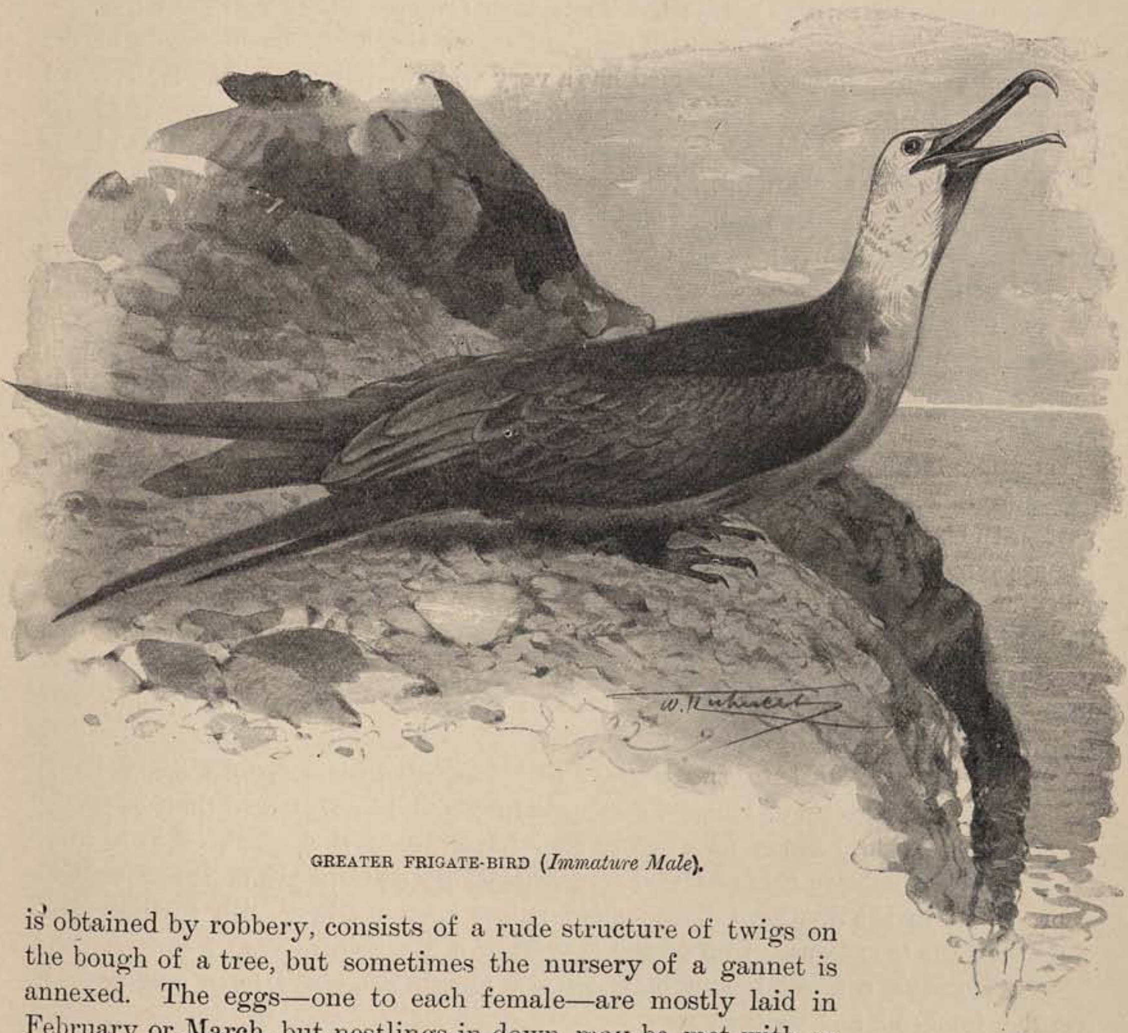


WHITE-TAILED TROPIC-BIRD.

Tropic-Birds. Widely different both in structure and habits are the beautiful tropic-birds of the family *Phaëthontidæ*, which take their scientific name from the circumstance that they seldom wander far from those parts of the ocean which underlie the apparent path of the sun. The group is represented by half a dozen species, all of which are most abundant to the south of the equator. Most of the species are of a pearly white colour, with a few black feathers, and they all have long wings and tails, with the middle pair of tail-feathers much exceeding the rest in length. In the white-tailed *Phaëthon æthereus* the beak is red and the tail white, whereas in *P. lepturus* (or *flavirostris*) the beak is yellow and the tail white, while in *P. rubricauda* the beak is red and the feathers of the tail are crimson with black shafts and narrow webs. The most beautiful species is, however, the yellow *P. flavus* of Christmas Island, in the Indian Ocean. The white-tailed and the red-tailed species breed as far north as Laysan Island, where there is a regular harvest of their eggs. On their way home from a sea-trip to the shore of this or other islands, tropic-birds after fishing half the day are often robbed of the results of their toil by predaceous frigate-birds and compelled to return home empty. On arrival, after taking their places by their hungry offspring, the old birds will often administer severe blows to the latter should they prove too importunate in their demands for the food which is not forthcoming. On Christmas Island the red-tailed tropic-bird breeds almost exclusively in holes in the cliffs, and is never seen flying about the trees. The yellow species, on the other hand, deposits its single dark brown and mottled egg on the floor of a hollow in a tree, with a mere apology for a nest. Although their flight is strong, these beautiful birds, on account of the rapidity of the strokes of the wing, appear as if labouring, and seldom sail with outstretched pinions. On hot days they may be seen flying among or around the trees in pairs or in threes, continually uttering their characteristic crackling cry, and occasionally hovering in front of holes in the trunks or boughs as though in search of suitable nesting sites. The breeding-season seems less definitely circumscribed than is the case among most birds, both eggs and young having been taken on Christmas Island in August and September.

Frigate-Birds.

Although, as indicated above, a deadly enemy, the greater frigate-bird (*Fregata aquila*) is a near relative of the tropic-birds, but represents, with the lesser species (*F. ariel*), a separate family, the *Fregatidæ*; the former species ranging over the tropical and subtropical zones of the oceans of both hemispheres, while the latter is restricted to the Indo-Pacific. From the *Phaëthontidæ* frigate-birds are readily distinguishable at a glance by their colour and shape, as well as by the forked tail; another feature being the deep scalloping of the webs of the toes, which are entire in the members of the other group. In colour adult males of the larger species are almost wholly black above, but white below, from the lower part of the breast; in young birds, however, the head and throat are rufous. In females the under-parts are white from the lower part of the throat, and they also have a large white patch on the flanks. Early in January the adult males begin to develop a great pouch of skin beneath the throat, which is brilliant scarlet in colour and capable of being inflated till it becomes nearly as large as the body. When taking to flight this bladder-like pouch, which only persists in its fully developed condition during the breeding-season, is generally allowed to collapse. For a great part of the year frigate-birds are denizens of the open ocean, where they are surpassed in flight only by albatroses; but during the breeding-season they are compelled, like tropic-birds, to resort to remote oceanic islands, where, as on Laysan and Christmas Islands, they congregate in enormous flocks. The food taken by their own exertions consists of surface-swimming species—as they never seem to dive—but much, if not the greater part, of their commissariat is obtained by despoiling tropic-birds and gannets of their hard-earned prey. When a gannet or a tropic-bird is overhauled by a frigate-bird, the marauder seizes the throat of its victim with its pincers-like beak to make it disgorge; and no sooner is a fish ejected from the crop than the frigate-bird swoops down with such velocity as to seize and pouch it before it can touch the water. On the shores of Christmas Island numbers of frigate-birds may be seen awaiting the return of the gannets from their fishing-grounds; the gannets, in order to avoid their enemies, fly low and endeavour to gain the shelter of the trees, but two or three frigate-birds will combine in the pursuit, and thus cut them off, in spite of doublings, from this harbour of refuge. The nest, for which most of the material is obtained by robbery, consists of a rude structure of twigs on the bough of a tree, but sometimes the nursery of a gannet is annexed. The eggs—one to each female—are mostly laid in February or March, but nestlings in down may be met with so late as August. According to an Australian naturalist, frigate-birds are used in the South Sea Islands as letter-carriers. If captured young, they will return, like homing pigeons, to the island of their birth, and, taking advantage of this trait, the missionaries forward such birds to islands with which they desire to hold communication. When released from their new domicile, they fly straight to their old home, where they alight on the identical perches on which they were accustomed to be fed.



GREATER FRIGATE-BIRD (*Immature Male*).

Gannets and Terns. Various gannets, such as *Sula cyanops*, *S. abbotti*, *S. sula*, and *S. piscatrix*, congregate in thousands during the breeding-season on the tropical islands of the area under consideration, but as they belong to the same genus as the European species, they require but brief mention in this place. How they are robbed by frigate-birds is referred to in the preceding paragraph, and it will suffice to add that while one of the species, *S. sula*, visiting Christmas Island nests on the ground or on cliffs in much the same fashion as its European relative, the other two, *S. abbotti* and *S. piscatrix*, make nests of twigs on tall trees. To sailors the tropical species of gannets are invariably known as "boobies." Certain species of terns, such as the sooty tern (*Sterna fuliginosa*), are likewise some of the birds most numerously represented on the islands and coasts of the Indo-Pacific. The species just named has a very wide distribution, ranging over the greater portion of the tropical and subtropical oceans with the exception of the American side of the Pacific. On the Island of Ascension, for example, these birds collect in such enormous numbers as actually to darken the sky when on the wing, and equally large numbers collect on Raine and Laysan Islands, although they do not appear to visit Christmas Island.

On still, warm days, mostly about noon, the terns of this species breeding on Laysan may be observed to rise from the water in a fan-like flock to a considerable height. In spite of the apparent want of order in which the thousands of birds move on the wing, the cylindrical shape of the flock is maintained as it rises and falls. These movements seem to have an attractive influence on other species, since tropic-birds, gannets, albatroses, and frigate-birds, although at other times on anything but good terms with the terns, gradually join the assemblage and take part in the evolutions. During the breeding-season sooty terns fly landwards from the sea punctually between three and four in the afternoon with their crops filled with food for their young, which are taken down to the water by their parents daily as soon as fledged. Flying a short distance ahead, the female bird encourages or cautions them by her call, which sounds like the words "wide-awake," and is uttered with varied modulations of tone, and answered by the feeble "peep-peep" of the young.

Noddies. Allied to the terns, and belonging to the family *Sternidæ*, is the group of tropical sea-birds to which, in allusion to their apparent stupidity and indifference to man, sailors have given the name of "noddies." These birds, which are characterised by their graduated tails, are most numerously represented in the Southern Hemisphere, where they are met with further from land than the true terns. One of the best-known representatives of the group is *Anous stolidus*, a sooty brown bird, with a grey head, black lores and beak, a whitish forehead, and brown feet.

Fairy Tern. The fairy tern (*Gygis alba*), typifying yet another group, with three species, ranges over the southern oceans as far west as the Seychelles. This beautiful white bird is distinguished by the long, forked tail, the slightly upward bend of the beak, and the deeply emarginate webs of the toes. The single egg is deposited on bare sand, on the crust of salt near the margins of lagoons, or on bare rocks and cliffs close to the surf, or even occasionally on a forked branch. However awkwardly the egg may be placed, the bird will always try to cover it with her body, and frequently succeeds in rearing a nestling in such a precarious position that special precautions are necessary in order to prevent its falling to the ground.

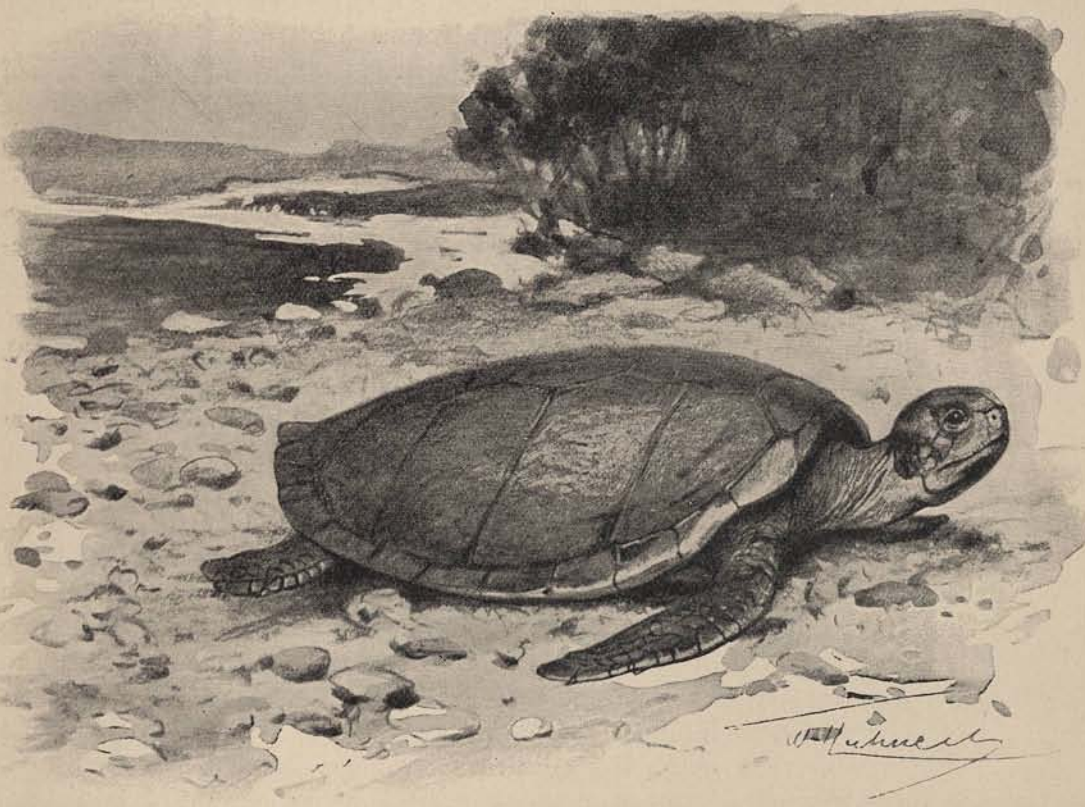
Skimmers. A small group of birds included in the tern family take their name of skimmers from the remarkable and unique conformation of their beaks, which are nearly as compressed as knife-blades, with the lower half projecting considerably beyond the upper one. Nocturnal in their habits, these birds pass the day reposing quietly in undisturbed situations, but rouse themselves towards evening, when they take to their wings and skim the surface of the sea so closely that they are enabled to sink the long lower half of the beak at intervals into the water and thus to scoop up and secure the small fishes and crustaceans which constitute their chief food. Skimmers, which range over the warmer parts of Asia, Africa, and America, and are represented by five species, not only frequent the shores of the sea and lagoons, but likewise resort to the banks of the larger rivers. The African scarlet-beaked species (*Rhynchops flavirostris*) is found, for instance, alike on the shores of the Red Sea and on the banks of the Nile, ranging over the whole of the coasts of the African continent with the exception of the extreme north and south. This bird, which may be recognised by its red feet and a beak vermilion for the greater part of its length but tipped with bright yellow, is dark brown above, with the crown and sides of the head, the neck, and the underparts white. In India and Lower Burma this species is replaced by the yellow-beaked *R. albicollis*, while in North and Central America the genus is represented by the pied *R. niger*.

Petrels. Omitting mention of the gulls of the Indo-Pacific, which present little of special interest, reference may be made to the black petrel (*Puffinus nativitatis*), which ranges from Christmas Island, in the Pacific, to the islands of the Phœnix group, on account of being one of several species which burrow in loose, sandy soil to such an extent as frequently to make walking on the shore a matter of extreme difficulty, as the thin layer of sand above the burrows of the birds breaks in with every footstep. During the day these birds remain in their subterranean dwellings, but at night they come forth, and utter cries that sound like most melancholy wailings, although the members of each pair sit side by side with an air of the most perfect content for hours at a stretch, From time to time one will gently scratch the plumage of its partner's neck, while both bill and coo like a couple of turtle-doves. Despite their apparent gentleness, these petrels should, however, be approached with caution, as a single bite from their pointed and crooked beaks is sufficient to produce a painful wound. A second species, the blue petrel (*P. hypoleucus*), is remarkable for the regularity with which it arrives at its breeding-places in the Pacific. On Laysan Island, for instance, where the black petrel also breeds, the blue species always makes its appearance between the 15th and the 18th of August. On arrival, the birds immediately proceed to reoccupy their burrows, when the first task is to remove with their feet the loose sand by which the entrances are blocked, this being generally performed by moonlight. Shortly afterwards the real business of breeding commences, the birds uttering throughout that season a peculiar kind of cooing cry, said to be somewhat intermediate between the mewing of a cat and the crying of a child.

Albatroses. Although brief reference to the albatroses on Laysan Island has been already made in the chapter on the animals of the Antarctic, it may be mentioned here that these birds make their appearance on that island several months after the arrival of the blue petrels, the usual date being the last week in October. When all these great birds have taken up their quarters in their breeding-places on Laysan and other lonely Pacific islands they specially affect, their numbers are so great that scarcely a spot is left unoccupied, and it not infrequently happens that some members of the colony have to seek accommodation on other resorts. The last birds to arrive naturally get the worst breeding-stations, and in many cases are compelled to establish themselves on the shores of lagoons covered during dry weather with a thin white crust of salt, which after a rain becomes mixed up with the underlying soil so as to form a kind of alkaline mud of a highly corrosive nature. In such situations the mortality among the young birds is very large, hundreds of their carcases covering the ground. Even, however, in more favourable localities numbers of young perish, owing to their parents being driven far away by storms or prevented from returning with food at the proper time. Young albatroses present at all times a somewhat comical appearance, and especially so when their downy coats are disarranged by the wind. Although to the human eye the young are so like one another as to be absolutely indistinguishable, the female parents never display the slightest difficulty in recognising their own offspring among the thousands which crowd the ground, even should they have strayed some distance from the spot where they were left in the morning.

So soon as the young are fairly developed, they begin to half run and half fly across the sand, daily getting a little nearer to the sea, even those that cannot see it, taking the nearest line to the shore. Once they have reached the water, nothing will keep them back, and in many cases they pay with their lives for their temerity, especially on steep shores washed by heavy seas. The species breeding on Laysan Island are *Diomedia immutabilis* and *D. sinensis*, the habits of which appear to be generally similar to those of the wandering albatros.

Turtles. Among the reptiles of the Indo-Pacific are the four well-defined species of marine turtles, none of them being, however, restricted to this area. All of them are characterised by their paddle-like limbs, but the leathery turtle, or luth (*Dermochelys*, or *Dermatochelys, coriacea*, also known as *Sphargis coriacea*), differs from the rest, and, indeed, from all other living members of the chelonian order by the peculiar structure of the shell. In ordinary turtles, as in land and fresh-water tortoises, the upper shell is firmly soldered to the vertebræ of the back and ribs, and consists of a number of bony plates varying in size and shape in different parts, but with the large lateral ones which overlie the ribs forming symmetrical pairs, and the whole being covered by horny plates, which are likewise arranged symmetrically, although they do not correspond in shape and size to the underlying bones. In the luth, on the other hand, the upper shell is quite distinct from the vertebræ and ribs, from which it can be lifted as a separate vaulted shield, composed of a number of small, mosaic-like pieces of bone not arranged in symmetrical lateral pairs; although there are five longitudinal ridges, on the back, to the presence of which the species owes its name of luth, since they are supposed to present a resemblance to an ancient lyre. The whole is invested in a smooth leathery skin. There is no lower shell, and the head cannot be retracted within the margin of the upper one. Peculiarities in the structure of the big skull, which cannot be discussed here, are likewise characteristic of this species. In size the leathery turtle, which is the sole living representative of the family *Dermochelyidæ*, or, properly, *Dermatochelyidæ*, is the largest existing member of its order, specimens occasionally attaining a length of six and a half feet, and weighing, it is estimated, about half a ton. Although by no means common, leathery turtles are found in all the warmer seas, inclusive of the Mediterranean, and are occasionally carried by the Gulf Stream to the south-western coast of Great Britain. In spring they resort to the Bahamas, the Tortugas (or Turtle) Islands, and the coast of Brazil, for the purpose of laying their eggs in sandy shores. The luth is a strictly carnivorous species, subsisting on fishes, molluscs, crustaceans, etc., and its flesh is consequently unwholesome.



GREEN TURTLE.

Of the typical turtles, constituting the family *Chelonidæ*, a well-known representative is the green or edible turtle (*Chelone mydas*), which is as widely distributed as the luth, but in the breeding-season is met with in large numbers on the sandy coasts of tropical islands and continents. Although occasionally growing to as much as 4 feet, it is in most cases considerably smaller. It is a bold swimmer, venturing without hesitation into the wildest surf; and, indeed, it is not easy to see how such a strongly protected reptile could well come to harm. Unlike the luth, the green turtle feeds exclusively on seaweeds; and it is currently reputed that, after eating its fill, it is in the habit of biting off large pieces of seaweeds and rolling them up into balls which are carried by the retreating tide out to sea, where they afford a food-supply for future occasions. The extensive use of the flesh of this species for food is too well known to require further mention.

The second member of the group is the hawksbill turtle (*C. imbricata*), characterised by the beautiful yellow and brown marblings of the horny plates overlying the shell, which in immature specimens overlap one another like the slates on a roof, although in fully adult individuals their edges come into contact with one another. In size this species is somewhat inferior to the green turtle, from which it is broadly distinguished by its carnivorous habit, and the consequently uneatable character of its flesh. The hawksbill affords the main source of supply of commercial tortoiseshell, of which the best quality comes from the Malay Islands, although large quantities are also imported from the West Indies, South America, and the Red Sea. Tortoiseshell, when heated in boiling water or steam, possesses the property of welding together like iron, and it is by this means that large plates are obtained. The highly priced and much admired golden yellow tortoiseshell is obtained by cutting out pieces of this colour from the lower shell and welding them together.

The third member of the group is the loggerhead (*Thalassochelys caretta*), which differs from the other two by having at least five, instead of only four, pairs of horny shields on the sides of the upper shell, and on this account, coupled with other differences, is classed in a genus apart. It is considerably the largest of the three species, and inhabits all tropical seas.

Crocodile.

In regard to crocodiles, which are more fully referred to in other chapters of this work, it will be sufficient to mention that the group is represented on the coasts of the Indo-Pacific by the widely distributed *Crocodilus porosus*, which, as previously stated, ranges from the Mascarene to the Fiji Islands, and from Korea to India and the northern coast of Australia, and frequently ascending rivers for considerable distances.

Sea-Lizard.

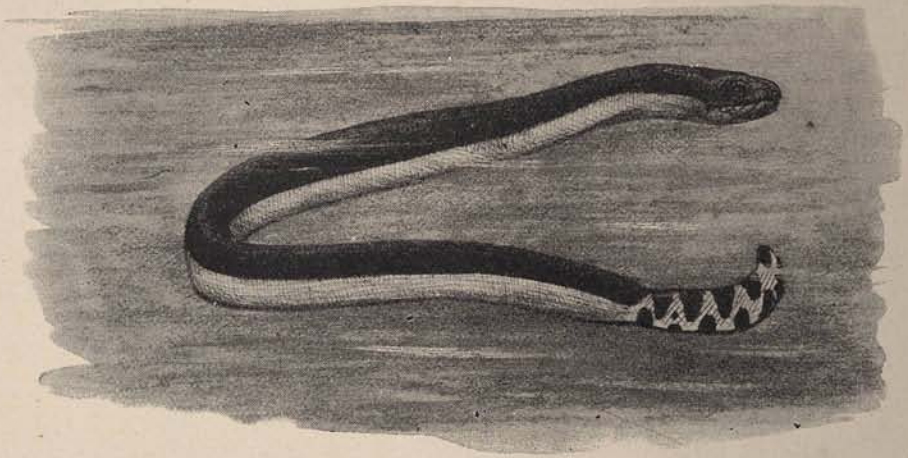
Although properly speaking a member of the land-fauna of that group, the curious sea-lizard (*Amblyrhynchus cristatus*) of the Galapagos Islands, the sole member of its genus, may, on account of its marine habits, be allowed to occupy a place in the present chapter. This reptile, which grows to a length of rather more than four feet, is characterised by the blackish colour of its rough skin, and by the presence of a continuous crest of horny spines running from the back of the head along the whole length of the back and tail. It has the same blunt and shortened head as its lighter-coloured land cousin, *Conolophus cristatus*, referred to in the notice of the Galapagos fauna. The sea-lizard subsists solely on seaweeds, which it obtains by diving to a considerable depth. It is a member of the iguana family, and formerly was to be met with in large numbers on and near its native islands, living, when on shore, on the rocky sea-beaches, from which it never departs on the landward side for a distance of more than about a dozen yards. Except when diving, these lizards are stupid and sluggish in their movements, and may occasionally be seen swimming several hundred yards away from the shore, when they remind the spectator of miniature alligators. When on shore, several individuals may frequently be seen in company basking in the rays of the tropical sun. To fit it for its amphibious mode of life, this lizard has all its toes fully webbed and the long tail laterally compressed so as to act as an efficient rudder in swimming.

Sea-Snakes. An almost exclusively marine group is constituted by the sea-snakes, which are related to the cobras, although forming a separate sub-family, *Hydrophiinæ*, of their own. In all these snakes, of which there are several generic types, the tail is laterally compressed for the purpose of swimming, and in some kinds this compression extends also to the body. The scales are small, and in most of the species of nearly similar size all round the body, the enlarged transversely elongated scales on the lower surface of the bodies of ordinary snakes, which are used for progression on land, being generally absent. These snakes inhabit all tropical seas from the Persian Gulf to Central America, and are frequently found far out at sea: on land they soon die. One species, as previously mentioned, inhabits a fresh-water lake in the Philippines. All the species produce living young, and all are extremely poisonous. On the coasts of India fishermen are not infrequently bitten by them, and the bite in some cases proves fatal. They are for the most part marked with broad vertical bands of two colours, and their general colouring approximates to that of mackerel, thus being of an eminently protective type. The largest species of all, *Hydrus major*, is, however, an exception in this respect, as its vertical bands are alternately

GALAPAGOS SEA-LIZARD.

bright orange and black. The most widely distributed species is *H. platurus*, characterised by its yellow tail, spotted and barred with black.

According to a letter received by the writer some years ago from a correspondent in Samoa, the flesh of certain kinds of sea-snakes is highly relished as food by the native inhabitants of that island. Apparently the poisonous nature of these snakes varies according to the species, for the Samoans consider some of the species poisonous, and refuse to eat their flesh, while others are regarded as good food. It is somewhat difficult to identify these edible species, but two of them appear to be referable to *Platurus schistorhynchus*, the range of which extends from the Malay Archipelago to Samoa and the Tonga and Fiji Islands. Despite the poisonous nature of all of them, several kinds of sea-snakes in Japan are stated to be perfectly harmless to man, among these being the species mentioned above, which is said to be frequently handled by the fishermen of the Liu Kiu Islands without fear and without accident. The species of the genus *Platurus*, it may be added, are less exclusively marine than most of the other kinds, living near the shore, and occasionally climbing for a short time among the rocks, and sometimes even venturing still farther inland. They are enabled to do this by the relatively large size (as compared with the other members of the group) of the scales on the lower surface of the body, a feature in which they approximate to ordinary land snakes.



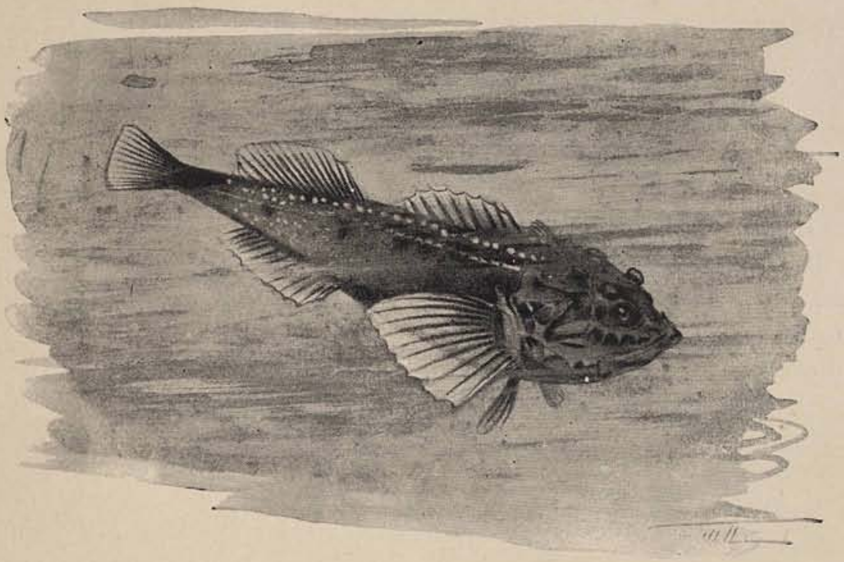
SPOT-TAILED SEA-SNAKE.

Mud-Skippers. Although fishes form the subject of a later chapter by themselves, the members of the curious group known as mud-skippers (*Periophthalmus*), on account of their shore-hunting mode of life, may be noticed here. Of these fishes three specific representatives are met with on the shores and estuaries of the tropics. They have remarkably prominent, goggle eyes, set close together, and each provided with a lid. These fishes are further characterised by their strong pectoral fins, which stand out from the body in an unusual manner, and thus enable their owners to walk and leap on dry ground or even to climb roots of trees and the steps of landing-places. At low tide mud-skippers may be seen hopping over the mud-flats on the shore or across small pools in pursuit of insects; and they are specially common on shores where interlacing masses of mangrove-roots are washed by the sea at high tide. One Malay species, *P. phya*, is noteworthy from the circumstance that it constructs a more or less permanent burrow, in which it takes refuge when alarmed, and where it remains in seclusion during bad weather. This burrow, which is frequented, apparently, by both sexes, may be employed as a nursery, although this point is not definitely ascertained. The larger burrows, which have funnel-shaped entrances, are always situated in pools of water between tide-marks; the water being retained in the pools by means of walls of mud from four to six inches in height and with a diameter of about eighteen inches, these being constructed by the fishes themselves. Outside the walls are a number of small holes, which may or may not lead into the central burrow and are employed as retreats on ordinary occasions. When, however, the fish are thoroughly alarmed they skip on to the walls, where they sit for a time before diving into the pools and seeking safe refuge in one of the large burrows, which always run in an oblique direction. According to native reports, these fishes obtain the mud or clay of which the walls are built by diving to the bottom of the pool and bringing up a mouthful at a time; this being confirmed by the appearance of the wall itself, which is formed of pellets of clay differing in character from the surrounding surface-mud, and of such a size and shape that they might well be casts of the fish's mouth.

KOELREUTER'S MUD-SKIPPER.

The commonest and most widely spread species is *P. koelreuteri*, which ranges from the Red Sea to the Pacific islands, and measures about six inches in length. A member of the group inhabits the West African coast in the neighbourhood of the Niger; but these fishes are unknown on the opposite American coast.

Insects. In addition to the numerous species to be met with on the shore, there are certain kinds of insects which actually live on the surface of the open sea, miles away from land; these being the so-called sea-flies or sea-bugs, which are represented by about fifteen different species. Among these is the silky-haired *Halobates sericeus,* restricted to the Pacific, which is only an eighth of an inch in length, and in colour grey above and silvery white beneath. These minute insects, it is reported, feed on the freshly dead bodies of small marine organisms, as well as on the juices of jelly-fishes. Although several other kinds of insects will venture for short distances into the water on the margin of the retreating tide, the species under consideration, which are members of the great group of bugs, Hemiptera-Homoptera, are the only ones living on the surface of the open ocean. They are quite devoid of wings, and carry the middle pair of legs thrown across the back, so that they are placed immediately over the hind ones. For a certain period the female carries the eggs on her own body, but later these become attached to some foreign substance, such as a feather or a piece of cork, on which they are carried about until the young *Halobates* are hatched.



FOUR-HORNED SCULPIN.

CHAPTER III

TROPICAL AND SOUTHERN FISHES

To deal adequately with the teeming fish-life of the tropical and subtropical seas, let alone to describe the brilliant colouring and beautiful patterns of many of the coral-haunting species, would require at least as many pages as form the present volume. All that can be attempted here is to direct the attention of the reader to a few of the more striking and interesting types of such fishes.

The great richness of tropical seas in fish-life, that is to say in the number of species rather than in the number of individuals, is dependent in all probability on the multitude of small islands in many of these oceans, the generally favourable natural surroundings, and the abundance of food. The brilliancy of colouring and the beauty of pattern in tropical fishes may perhaps be attributed, on the other hand, as in the case of birds, to the stimulating influence of abundant and intense light and warmth.

Beryx Group. Commencing with the great group of perch-like fishes, we have first of all the species of the genus *Beryx*, typifying the family *Berychidæ*. These are for the most part deep-water fishes, for which there appear to be no English names, but the members of two of the genera are notable as being surface-feeding fishes inhabiting the tropical seas, and of good quality for the table. The surface-haunting genera are *Myripristis* and *Holocentrum*, each of which has a large number of species, averaging about fifteen inches in length, and for the most part pinkish in colour above and silvery below. The members of the first-named genus are characterised by the short snout and oblique mouth, whereas in the second genus the snout is produced into a kind of beak and the mouth horizontal. The deep-sea forms are characterised by the great development of the mucus-bearing cavities in the head.

Mullet-Kings. The fishes commonly known as mullet-kings represent the genus *Apogon*, and form a well-known group belonging to the family *Serranidæ*. These are small fishes, the great majority of which frequent coral-reefs, and, like all fishes of similar habit, are brilliantly coloured and elaborately marked, probably in order to accord with the bright colours of the coral-polyps around and amid which they swim. The family *Serranidæ* is a very large one, including the members of the typical genus *Serranus*, of which several kinds inhabit the Mediterranean, where they often inflict serious wounds on persons bathing or swimming. The perch-like fishes of the genera *Polyprion* and *Mesoprion* are likewise members of the same family.

Tile-Fish. Considerable interest attaches to the tile-fish (*Lopholatilus chamæleonticeps*), a member of the family *Pseudochromididæ*, remarkable not only for its brilliant coloration—perhaps unequalled by any other non-tropical fish—but for its curious history. This species, which grows to a considerable size, first made its appearance off No-Man's-Land, Massachusetts, in 1879, when a specimen was taken in deep water on a cod-line. Soon after it could be taken in abundance with the same kind of apparatus, a catch of some 250 lb. of fish (ranging individually from 10 lb. to 40 lb.) in the course of a couple of hours or less being not uncommon. This raised the hopes of fishermen, and in 1881 it was stated that there was every reason to believe that the tile-fish would rank among the most important food-fishes of the United States. About the same time, when the fishermen were getting into the swing of the fishing, the tile-fish, owing to ice in the Atlantic, disappeared as suddenly as it came, and it is only during the last twenty years that it has revisited the American Atlantic coast, where it can now be taken at a depth of about seventy fathoms in the warm waters of the Gulf Stream.

Ombre and Drum-Fish. Among the numerous representatives of the family *Sciænidæ*, which are near relatives of the *Serranidæ*, reference may be made to the Mediterranean fish known as the ombre (*Umbrina cirrhosa*), which ranges so far southward as the Cape; the genus being also represented by allied species in the Indian Ocean. Another well-known member of the family is the drum-fish (*Pogonias chromis*) of the Atlantic coast of North America, which takes its name from the loud drumming noise it makes, possibly by clapping together the pavement-like teeth in the gullet. This species grows to about four feet in length, and may weigh nearly a hundredweight. The typical member of the family is, however, the shadow-fish (*Sciæna aquila*), which ranges from the coasts of Great Britain to those of Australia, the genus to which this particular species belongs having an extensive distribution in the Atlantic, Indian, and North Pacific Oceans. The meagre, as the shadow-fish is frequently termed, is a strong and handsome fish, also well known on account of the strange sounds it produces, which are of the same general type as those of its cousin the drum-fish.

Long-Fins. Of special value as food-fishes are the long-fins of the genus *Chilodactylus*, which, with *Haplodactylus* and a few other genera, constitute the family *Haplodactylidæ*. Of the long-fins, which take their name from the great production of the pectoral fins, most of the numerous species inhabit the South Pacific. In all the members of the family the lower rays of the pectoral fins are thick and undivided, and are apparently employed as organs of touch.

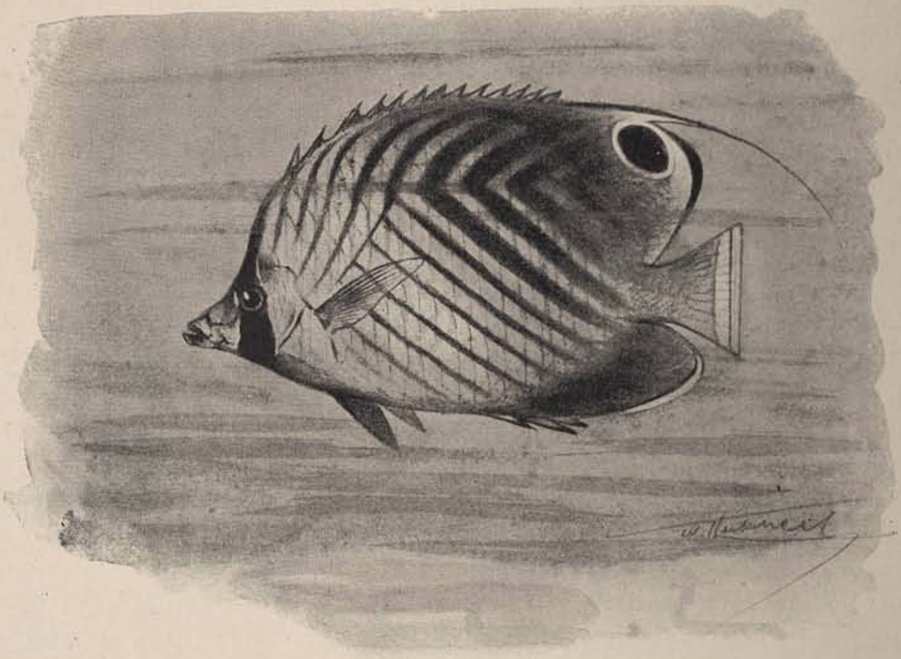
Pristipoma. Another large group of tropical fishes of the perch section is formed by the numerous species included in the genus *Pristipoma*, which typifies a family containing several other genera. These fishes, as a rule, are dull in colour and medium in size.

Red Mullets. Omitting mention of the great family of sea-breams (*Sparidæ*) of which there are some two hundred species, with numerous genera, distributed over nearly all seas, we come to the nearly related family of red mullets, or *Mugilidæ*. These fishes are chiefly characteristic of temperate and tropical seas, but are more abundant in the Eastern than in the Western Hemisphere. They feed mainly on crustaceans, to which they owe their brilliant red colouring, and have long been in high repute for the table. In the common red mullet (*Mullus barbatus*), the favourite fish of the old Roman epicures, the colour is uniformly red and the profile vertical; the range of the species extending from Scandinavia to the Canaries. In the striped mullet (*M. surmuletus*), on the other hand, the profile of the head is usually oblique, and the sides of the body are longitudinally striped with yellow. This fish, which may or may not be entitled to specific rank, is moderately common in summer off the coasts of the south and west of England, to which the red mullet is only an occasional visitor. To an allied family, *Caproïdæ*, belongs the well-known boar-fish (*Capros aper*) of the Mediterranean and North Atlantic, remarkable for the hair-like bristles on its scales.

Scaly-Finned Group. Special interest, on account of the brilliant colouring and striking ornamentation of its members, attaches to the group of scaly-finned fishes forming the family *Chætodontidæ*, which are easily recognised by the deep form of the body and the extension of the scaling on to the vertical fins. These fishes are for the most part characteristic of the tropical seas in the vicinity of coral-reefs, and are all more or less carnivorous in habit. Among them, the species known as *Chelmo rostratus* is noticeable on account of the prolongation of the muzzle into a short tube. In colour this fish is white barred with four dark stripes margined with brown and white; the fleshy portion of the dorsal fin bearing a number of round, black-edged white spots. From its tube-like beak, this fish was supposed to have the power of squirting drops of water on insects on shore; but as it is a salt-water species, it is highly improbable that it eats insects at all, and it seems most likely that its alleged squirting powers are due to its having been confounded with the Indo-Malay archer-fish (*Toxotes jaculator*), referred to in the section on the Australian fauna.

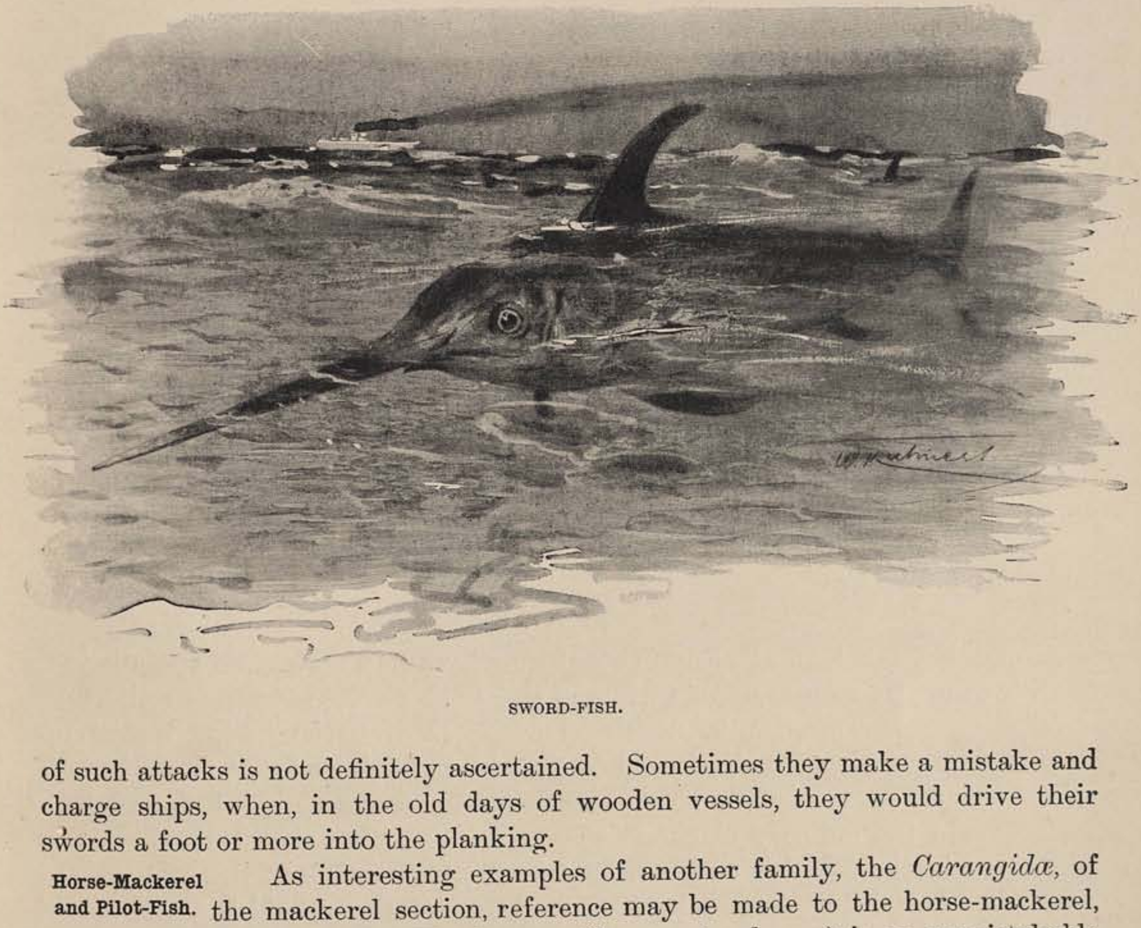
The warmer regions of the Indian and Pacific Oceans are the home of a strikingly coloured species known as the bristle-fish (*Chætodon setifer*), the typical representative of the whole family, and a member of a large and widely distributed group. It derives its name from the elongation of the fifth ray of the dorsal fin. To the same family also belongs the gorgeously coloured emperor-fish (*Holacanthus imperator*), resplendent with longitudinal stripes of gold upon an azure ground. This fish is an Indian member of a large tropical group, all of which are highly esteemed for the excellence of their flesh. The members of this particular genus may be recognised by the elongation of the fourth ray of the dorsal fin into the shape of a whip-lash; one of the most common species being the whip-fish (*H. macrolepidotus*) of Mauritius and north-western Australia.

Wrasses. The well-known wrasses form a large family of, for the most part, brilliantly coloured fishes frequenting all tropical and temperate coasts. They take their scientific name of *Labridæ* from their thick, projecting lips. Ten or more species or races are known from British waters, of which the most abundant are the Ballan wrasse (*Labrus maculatus*) and the striped wrasse (*L. mixtus*). In the latter the two sexes are coloured differently, the males being striped with blue, while the females are blotched with black. Among the numerous tropical and southern genera, the coral-wrasses (*Platyglossus*) are restricted to the coral-zone, and, like all fishes with that habitat, are the most gorgeously coloured of their family.



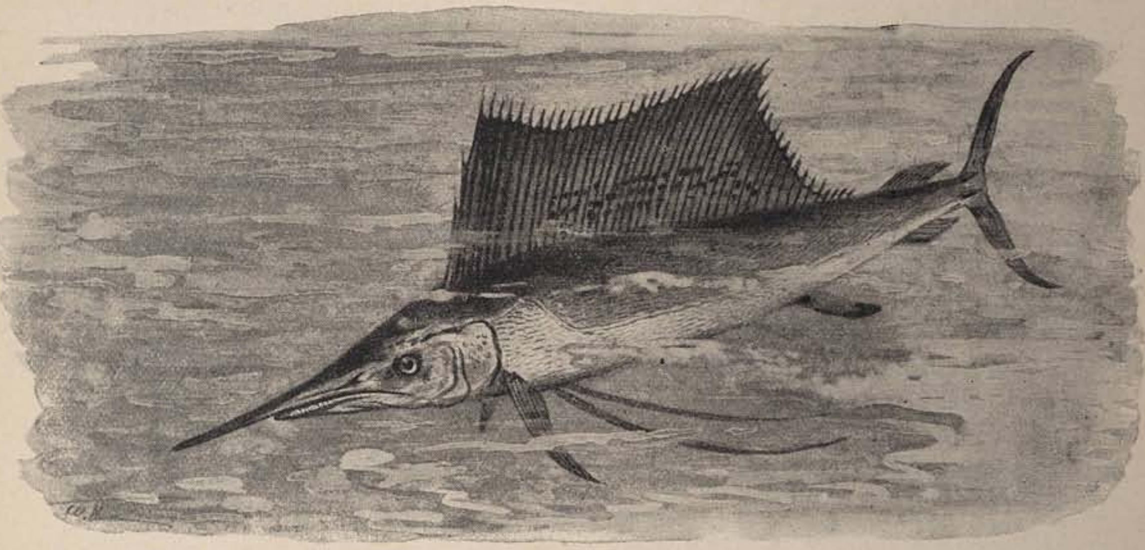
BRISTLE-FISH.

Sword-Fishes. Our next representatives of the spiny-finned group of bony fishes are the sword-fishes and sail-fishes of the families *Xiphiidæ* and *Histiophoridæ*, which belong to the pelagic mackerel-like section, and are the largest members of the entire order. These fierce and predaceous fishes derive their name of sword-fish from the long spear-like prolongation of the upper jaw, while the sail-fishes, which are similarly armed, take their title from the enormous back-fin, which plays the part of a lateen-sail when they are swimming at the surface. The ordinary sword-fish (*Xiphias gladius*) of the Mediterranean and North Atlantic alone represents a genus in which the hind, or pelvic, pair of fins is absent; whereas in the sail-fishes, such as *Histiophorus gladius* of the Indo-Pacific, these fins are retained in the shape of long tapering rods. The muzzle of the sail-fishes is also more triangular, with a less sharp cutting-edge, so that on the coasts of Madras and the South Sea Islands it is comparatively easy to capture them when young in nets. In length these fishes may reach as much as fifteen feet, with a "sword" of a yard long. In the young both jaws are of equal length, and carry small pointed teeth, while the fin on the back is of medium length. With increasing age the back-fin grows abnormally, and the remnants of the pelvic fins make their appearance in the sail-fishes; soon afterwards the upper jaw begins to lengthen, and eventually assumes the characteristic adult form, while at the same time the teeth disappear. These fishes, which are carnivorous and highly ferocious, frequently ram whales with their formidable weapons, although the precise purpose of such attacks is not definitely ascertained. Sometimes they make a mistake and charge ships, when, in the old days of wooden vessels, they would drive their swords a foot or more into the planking.



SWORD-FISH.

Horse-Mackerel and Pilot-Fish. As interesting examples of another family, the *Carangidæ*, of the mackerel section, reference may be made to the horse-mackerel, or scad, and the pilot-fish. The former (*Caranx trachurus*) is an unmistakable fish on account of the lateral mucus line on each side of the body being protected by a series of seventy-three large bony plates, which become keeled on the tail. On the coasts of the west of England scad sometimes make their appearance in enormous numbers, which literally choke the smaller harbours. The pilot-fish (*Naucrates ductor*), which is a truly pelagic tropical species, occasionally accompanying vessels into British waters, takes its name from its reputed habit of conducting sharks to their prey, when, like the honey-guide in the case of the honey-badger, it claims a portion of the feast. Be this as it may, it is certain that pilot-fishes accompany large sharks and ships in their course. This fish, which is of medium size, is easily recognised by the broad dark blue vertical bands on the sides of the body which extend upwards on to the unpaired fins. In the abyssal depths of the North Pacific the *Carangidæ* are represented, among other species, by the one known as *Anomalops palpebralis*, which, like so many deep-sea fishes, is probably self-luminous. Here may be mentioned two luminous fishes, *Photoblepharon palpebratus* and *Heterophthalmus catoptron*, from the Malay Archipelago, both of which are of small size, and belong to the present family. They are remarkable among luminiferous fishes in being shallow-water forms, the first named dwelling among stones at the bottom, while the second is a free-swimmer. Their light-organs, which are situated in the skin, resemble generally those of deep-water luminous fishes, though they have certain structural peculiarities of their own. The whole upper surface of these fishes appears to be luminiferous.

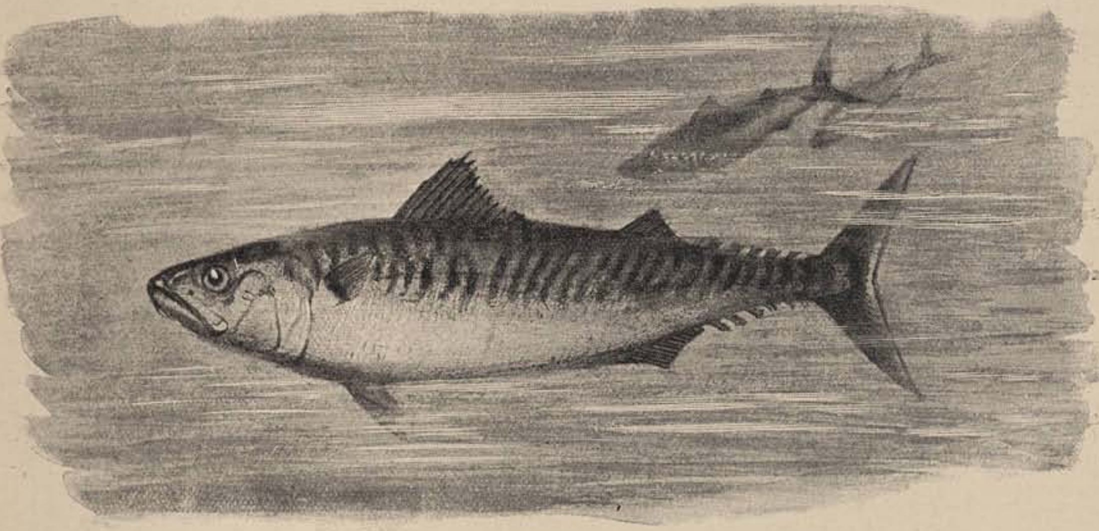


SAIL-FISH.

Mackerel. The familiar mackerel (*Scomber vernalis*) is the typical representative of a family (*Scombridæ*) of pelagic fishes, most of which carry a small series of finlets between the tail and the unpaired fins of both surfaces. In the ordinary mackerel there are five such finlets both above and below, but in the Spanish mackerel (*S. colias*), which differs by the possession of an air-bladder, there may be either five or six. Mackerel, which are found in every tropical and temperate sea, but more especially the western South Atlantic, afford an excellent example of protective colouring, the barring of black and green on the back harmonising when seen from above with the ripple amid which these fishes swim, while the pinkish silvery sheen of the lower surface renders them as inconspicuous as possible when viewed from below against the light of the sky.

Tunny and Bonito. Scarcely less valuable as a food-fish is the tunny (*Thynnus mediterraneus*), which has eight or nine finlets, and ranges from the South Atlantic to the South Pacific. It is occasionally taken on all parts of the British coasts and also off Tasmania, although it is most systematically fished in the Mediterranean. Tunnies grow to a huge size, unusually large examples weighing nearly half a ton. Their beef-like flesh is conspicuous in Italian fish-markets. Closely allied is the bonito (*T. pelamys*), a species inhabiting all tropical seas, where it may often be seen in pursuit of the shoals of flying-fish; but it also ranges in the North Atlantic to the coasts of Scotland and Norway. Much the same may be said with regard to the belted bonito (*T. sardus*), distinguished by the presence of dark bands on the blue ground of the upper-parts.

Here may be noticed an interesting type of scombroid fish from Argentine waters named *Chenogaster holmbergi*, which is a member of the same group as the New Zealand *Lepidothynnus* and *Gasterochisma*. From the New Zealand forms *Chenogaster* differs by the united dorsal fins, while it is distinguished from *Gasterochisma* by the small pelvic fins and from *Lepidothynnus* by the presence of vomerine teeth. The three genera represent a circumpolar Antarctic group.

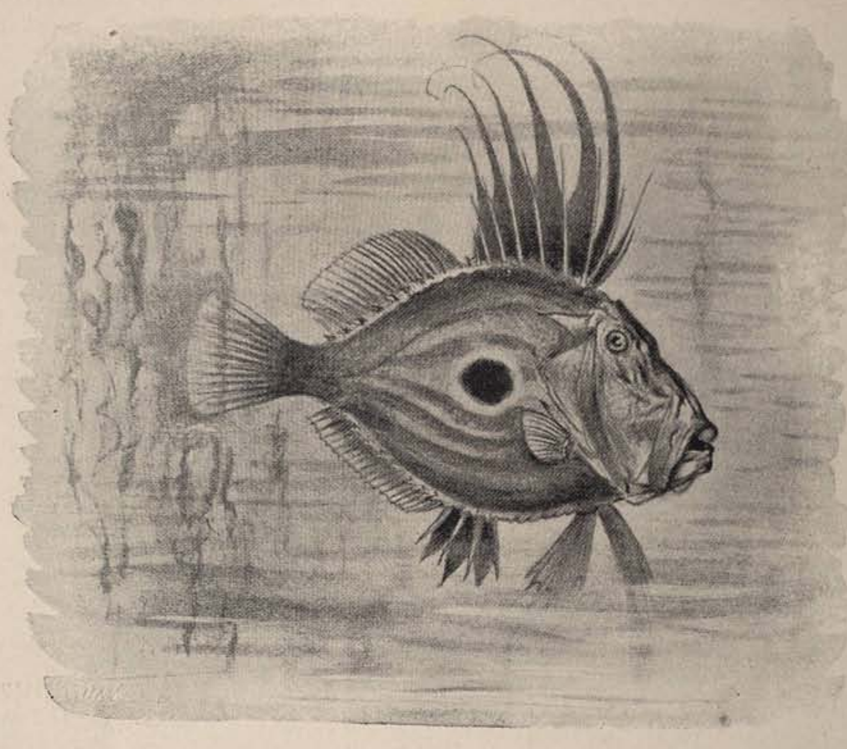


MACKEREL.

Dolphins. To the same section belong the large pelagic predatory fishes of the family *Coryphænidæ* and the genus *Coryphæna*, popularly miscalled "dolphins." Both of the two species, which grow to about six feet in length, accompany bonito in the pursuit of flying-fishes. They may be recognised by the deep, short-snouted head, and the long, slender body, terminating in a deeply forked tail.

Flat-Fishes and Dory. The flat-fishes, which were formerly placed next the cod tribe, are now regarded as specialised members of the spiny-finned group, nearly related to the John Dory (*Zeus faber*). These *Pleuronectidæ*, as they are called, inhabit all temperate and tropical seas, the species from the tropics being characterised, as a rule, by the brilliancy of their colouring. Among the Indo-Pacific genera of these fishes are *Pseudorhombus* and *Rhomboidichthys*, both of which have the eyes on the left side, the latter being also characterised by the presence of eye-like spots on the brightly coloured upper surface. A third tropical genus, *Synaptura*, has the eyes on the right side; the score or so of species, with the exception of two, being restricted to the Indian Ocean. On the other hand, the members of the genus *Gymnachirus*, easily recognised by the absence of scales, are confined to the tropical Atlantic; while *Rhombosolea* is a native of New Zealand waters. A noteworthy type is *Cynoglossus*, characterised by the elongated snout, and its long narrow shape, which has led to the name of "dog's tongue." Although distributed throughout the Indian seas, these flat-fishes are specially abundant off the coast of China.

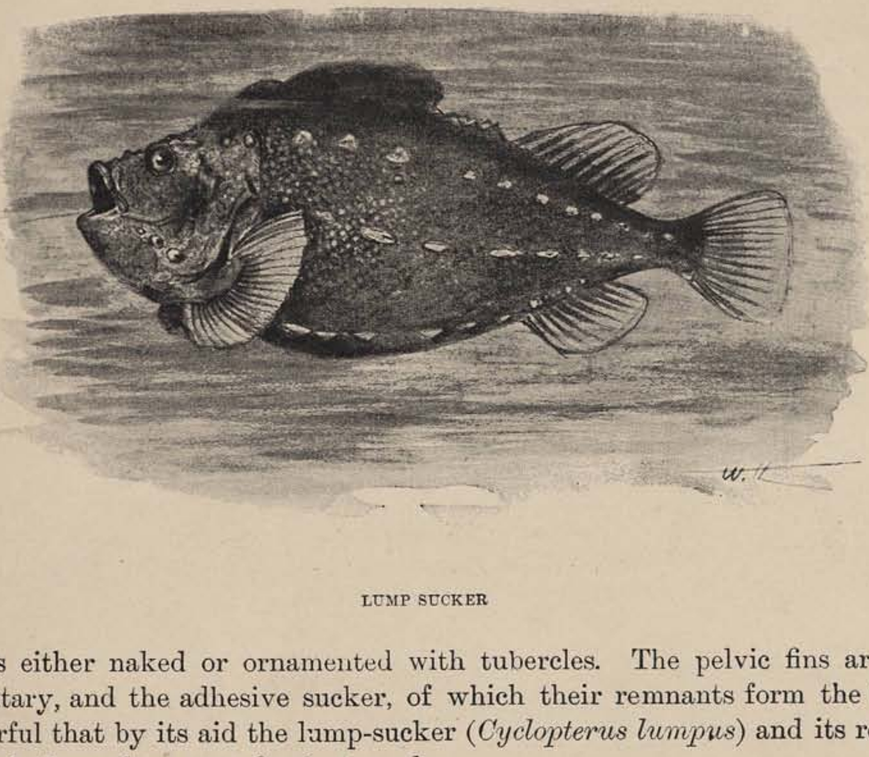
The John Dory is the typical representative of a family, *Zeidæ*, which may be regarded as a survivor of the ancestral stock of the flat-fishes; the body being greatly compressed, although the head is symmetrical. Curiously enough, however, dories swim a little obliquely in the water, as though showing a tendency towards the flat-fishes. In addition to their peculiar form, these fishes may be recognised by the tall and cleft front dorsal fin, the protractile, sucking mouth, and the large white-bordered black spot on the side which is believed by some to have been the origin of the name. Although not infrequently taken in the British seas, the dory is essentially a warm-water fish, and is abundant in the Mediterranean, whence the geographical range of this or closely allied species extends to Japan, Australia, and New Zealand. A very similar distribution characterises the three species of the nearly allied genus *Cyttus*, of which the range extends from Madeira to Australia and New Zealand.



JOHN DORY.

Gobies and Lump-Suckers. Another section of the spiny-finned group is represented by the small fishes commonly known as gobies (*Gobiidæ*), in many of which the pelvic fins coalesce to form a suctorial disc by means of which these fishes are enabled to adhere to pebbles and other objects. These fishes are most numerously represented in tropical seas, but many of them are inhabitants of brackish waters, while others are found in rivers and lakes. The commonest species on the British coasts are the rock-goby (*Gobius niger*), the single-spotted *G. minutus*, and the two-spotted *G. ruthensparri*. The mud-skippers (*Periophthalmus*), referred to in the preceding chapter, are members of the goby family.

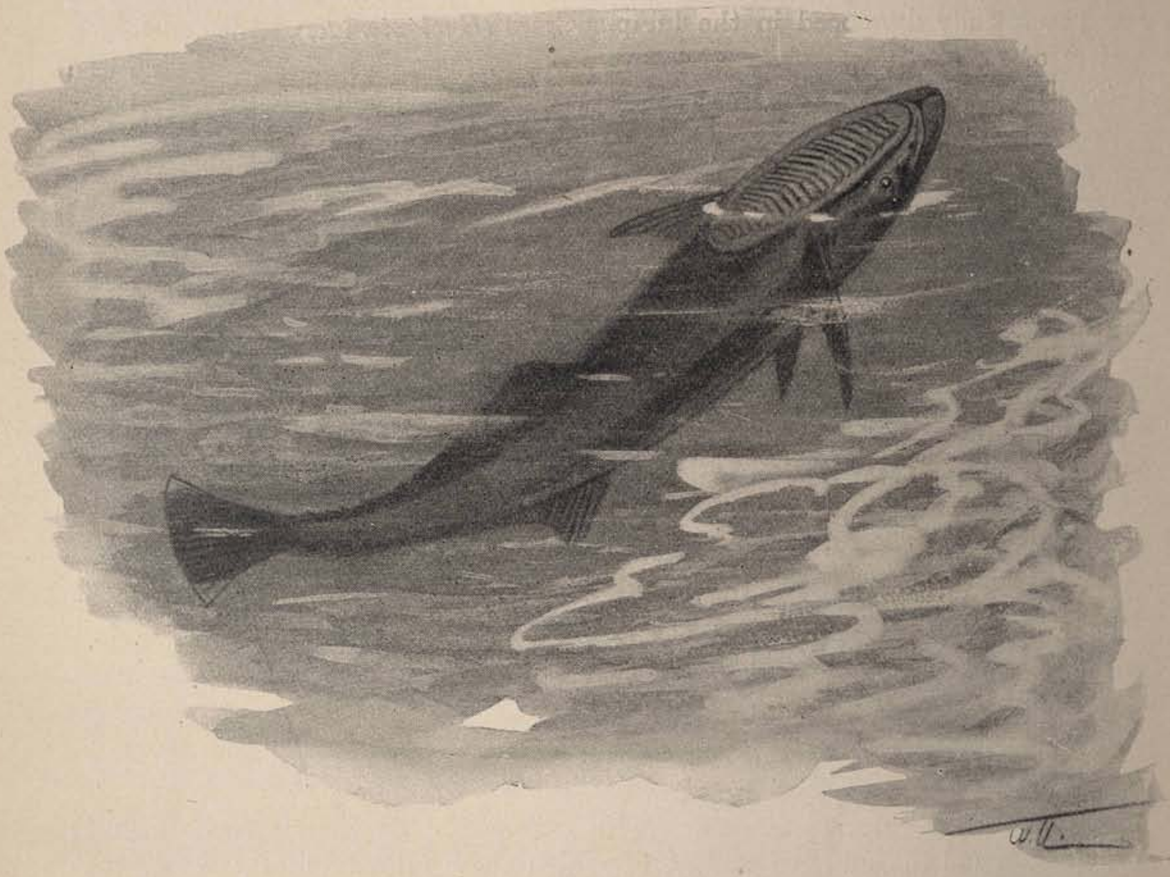
The sucker-like disc formed by the coalesced pelvic fins of the gobies is found more fully developed in the lump-suckers (*Cyclopteridæ*), which, although natives of the north temperate and Arctic zones, may be appropriately noticed here. They are characterised by the clumsy form of the thick and oblong body, which is either naked or ornamented with tubercles. The pelvic fins are quite rudimentary, and the adhesive sucker, of which their remnants form the base, is so powerful that by its aid the lump-sucker (*Cyclopterus lumpus*) and its relatives can attach themselves very firmly to rocks.



LUMP SUCKER

Sculpins. Another mainly northern type, which may be noticed here on account of its having a representative (*C. intermedius*) on the coast of Japan, is the genus *Cottus*, the American members of which are commonly termed sculpins, although that name is used in another sense in England. These fishes, which represent a family, the *Cottidæ*, by themselves, are best known by the European fresh-water "miller's thumb" (*C. gobio*), but the majority are marine. They range as far north as Greenland, Labrador, and Kamchatka; and are near relatives of the lump-suckers, from which they differ by the normal character of the pelvic pair of fins, and the comparatively large size of the gill-openings, which are very small in that species.

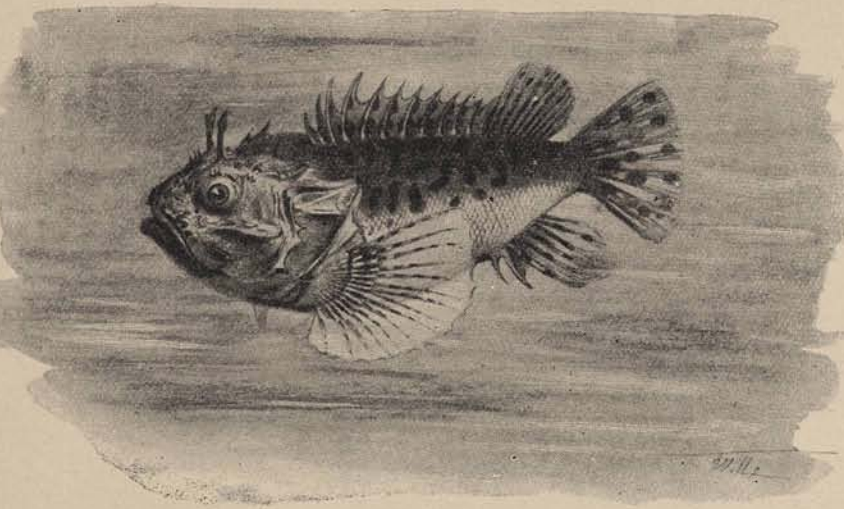
Sucker-Fishes. An altogether aberrant section of the spiny-finned group is represented by the sucker-fishes of the genus *Echeneis*, alone constituting the family *Echineidæ*. In these remarkable fishes the first dorsal fin is modified into a very complex adhesive disc, by means of which they attach themselves, belly-uppermost, to sharks, turtles, and ships, thereby obtaining an abundant food-supply without any active exertions on their own part. In accordance with this reversed position the remora and its relatives have the under surface of the body dark and the upper side silvery, so that any one handling a specimen for the first time is almost sure to mistake the back for the belly. Out of some half-score species, one of the most widely distributed is the remora of the ancients (*Echeneis remora*), which attains a length of about eight inches, or approximately one-fifth that of the equally common *E. naucrates*, the gapu of the Papuans of Torres Strait. These fishes are essentially denizens of the tropical seas, although when attached to ships they are frequently carried into colder waters. In Torres Strait the natives employ the gapu in capturing turtles; the fish, with a line passed though its gills and attached to its tail, being carried on the bottom of the canoe. When a turtle is sighted, the gapu is thrown into the water and immediately makes for the reptile and attaches itself to the shell. In the case of small turtles, they are forthwith hauled in hand over hand, but when the gapu attaches itself to larger



GAPU SUCKER-FISH.

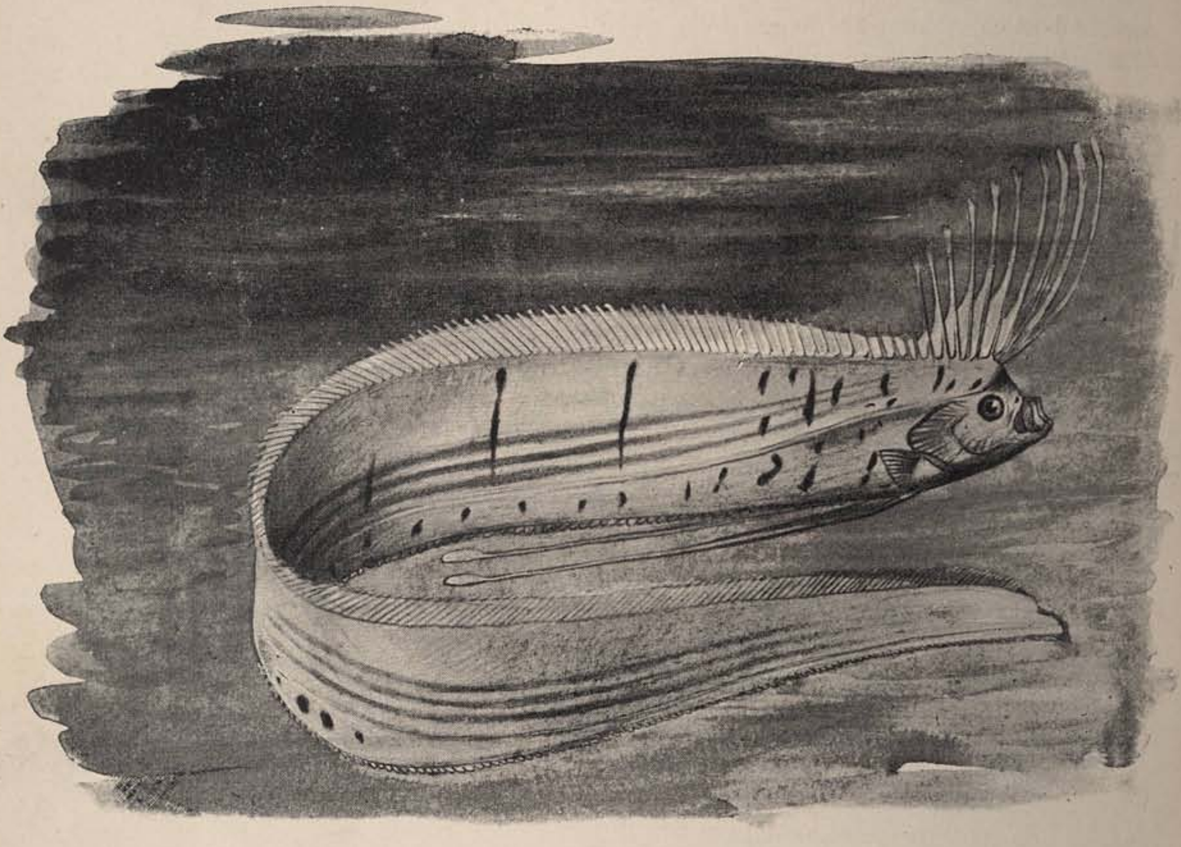
ones, a native swims to its assistance with a second and stronger line, which is made fast to one of the flippers.

Scorpænas. The ugly fishes known as *Scorpæna*, together with their immediate relatives, constitute the first family (*Scorpænidæ*) of another section of the spiny-finned fishes. As characteristic features of the scorpæna and its allies mention may be made of the oblong and more or less compressed form of the body, and the presence of spines on the head, especially on one of the bones of the gill-cover, which is united by means of a projecting bar with the circle of bones round the eye. Some of these fishes are not unlike sea-perches, but others live on the sea-bottom, and are furnished with peculiar outgrowths of skin resembling seaweeds, and serving either for concealment or as lures to other fishes. In colour scorpænas generally assimilate more or less closely to their surroundings, their tints varying according to locality. Of the two Atlantic representatives of the typical genus, *S. porcus* is brownish red in colour, with darker spots and mottlings, and is inferior in size to *S. scrofa*, which grows to about thirty inches. The members of the genus *Sebastes* represent the perch-like type, while *Tetraroge*, *Pelor*, and *Synancia* form the abnormal types referred to above. Scorpænas are common in the Australasian seas, as well as in other parts of the South Pacific.


SCORPÆNA.

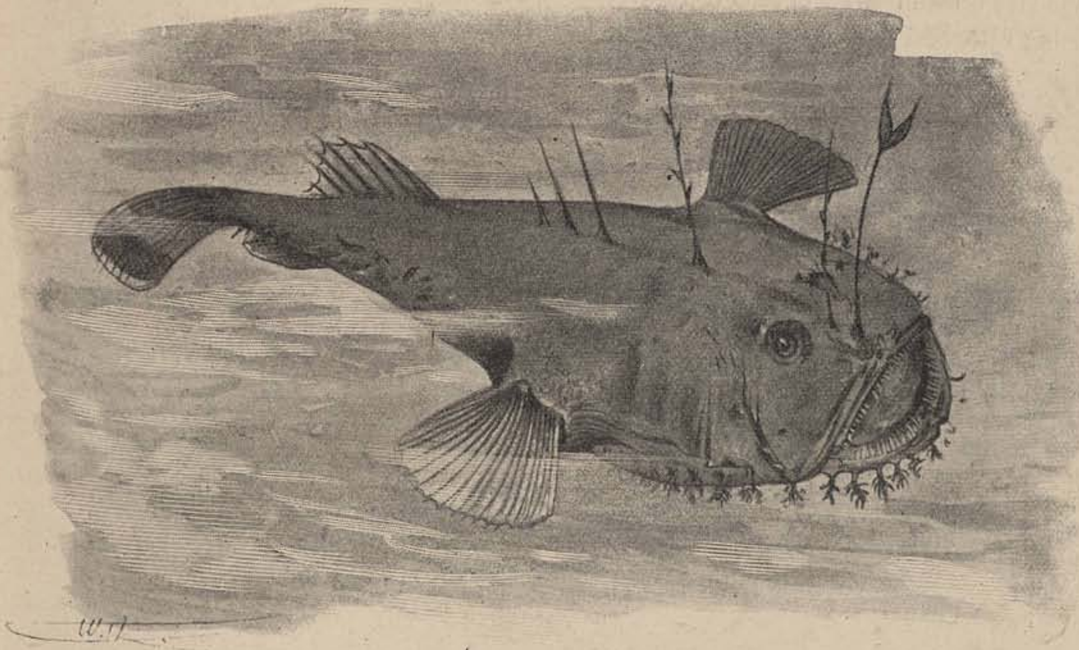
Gurnards. The well-known gurnards and their relatives the flying-gurnards respectively constitute two families, *Triglidæ* and *Dactylopteridæ*, belonging to the scorpæna section. Gurnards are remarkable for their brilliant red and blue colouring, and the finger-like prolongations of the pectoral fins, which are employed to search the sea-bottom for the shrimps and crabs on which these fishes feed. They are likewise noteworthy on account of the grunting sounds they produce by means of their air-bladders. The red gurnard (*Trigla cuculus*) and the sapphire gurnard (*T. hirundo*) are well-known British species; but all the four kinds of flying-gurnards of the genus *Dactylopterus* are inhabitants of the warmer zones of the Atlantic and the Indo-Malay seas. When adult, the pectoral fins are so prolonged as to enable these fishes to take flights in the air in the fashion of the true flying-fishes, although they are not prolonged to such distances.

Star-Gazers. Another section of spiny-finned fishes includes the curious star-gazers, forming the family *Uranoscopidæ*, and closely related to the well-known weevers, or *Trachinidæ*. These fishes are specially characterised by the scales being either small and arranged in oblique bands or absent. The star-gazers are represented by about a dozen species, of which all but *Uranoscopus scaber* of the Mediterranean inhabit the Atlantic and Indo-Pacific Oceans. These fishes take their name from the position of the eyes on the upper surface of the head, where they can be raised or depressed according to circumstances. They obtain their food by lurking among stones and luring prey within reach of their capacious mouths by means of the movements of a long filament situated below and in front of the tongue. North America is the home of certain star-gazers (*Astroscopus*), in which, as in the typical members of the family, the eyes are placed near the middle of the large, flat head in such a position that the line of vision is directed almost immediately upwards. In correlation with this peculiarity is the upward direction of the large and strongly armed mouth, which is likewise placed entirely on the upper surface of the head. Obviously such a fish cannot



BANKS'S OAR-FISH.

obtain its prey in the ordinary manner, and its mode of feeding therefore needs explanation. Possibly the explanation is to be found in the fact that the heads of these fishes are furnished with an electrical organ, which is of a type different from that of any other electric-fish. The power possessed by the star-gazers of emitting electric shocks appears to have been familiar for many years to the Virginian fishermen, but it is only lately that it became known to men of science. It is suggested that these fishes may kill their prey by electric discharges, and then catch them as they fall in the upturned mouth. Some support to this theory is afforded by the fact that the stomach of one specimen contained a number of small swift-swimming fishes.



ANGLER-FISH.

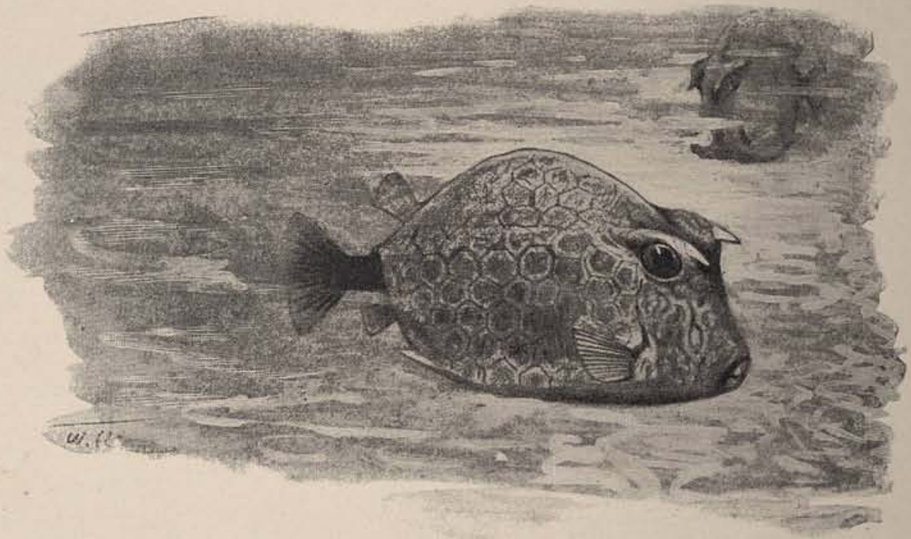
Ophidiidæ. To the same section belongs the family *Ophidiidæ*, the more typical members of which take their title from their long, eel-like bodies, furnished with continuous median fins, while they are further characterised by the frequent absence of the pectorals, and the more or less aborted condition of the pelvic pair. In the banded *Ophidium barbatum*, which is mainly a Mediterranean fish, although occasionally wandering into more northern latitudes, the pelvic fins are reduced to a pair of forked filaments placed near the throat. These fishes are probably degraded relatives of the blennies.

Ribband-Fishes. The ribband-fishes of the families *Trachypteridæ* and *Lophotidæ*, which constitute by themselves a section of the spiny-finned group, are so called on account of their extremely elongated and strap-like form and large size. Of the two British species, the deal-fish (*Trachypterus arcticus*) has the small, fan-like tail-fin set at an angle to the main axis of the body, as if it had been distorted, while the oar-fish (*Regalecus banksi*) is without this fin, and has the front rays of the dorsal fin curving forwards like the crest of a cockatoo.

The largest species of oar-fish, or "king of the herrings," grows to over twenty feet in length. For the most part these curious fishes are known by stranded examples.

Angler-Fishes.

A small section of spiny-finned fishes is typified by the family *Lophiidæ*, of which the huge and ugly angler-fish, or sea-devil (*Lophius piscatorius*), is a familiar British representative. These fishes resemble the star-gazers in enticing their prey within reach by means of lures; but in their case the lure is situated on the first spine of the dorsal fin, which is isolated and placed well forwards, so that the whiplash-like structure, with a tassel at the extremity, dangles above the enormous mouth. The teeth in the front of the jaws are so arranged that they incline inwards as the victim enters the capacious trap, but rise up and bar the exit if it attempts to escape. Owing to the pectoral fins being attached to a sort of arm formed by the lengthening of certain bones, these fishes, which may grow to between four and five feet in length, are able to walk to a certain extent on the bed of the sea. Nearly all the numerous species inhabiting shallow or moderately deep water are provided with the above-mentioned angling apparatus—the 'illicium'—which undoubtedly serves as a rod, line, and bait, although the action is probably automatic. Certain stoutly built members of the group are, however, denizens of deep water, and in these the fishing apparatus has been modified into a rod with a bulb furnished with a phosphorescent terminal portion, while the surrounding 'bait' has likewise been specialised and augmented; and, in addition to all this, a lantern and worm-like lures are present. How efficient must be this apparatus will be apparent to all who have witnessed salmon-spearing by torchlight.



COFFER-FISH.

Coffer-Fishes and File-Fishes.

A strange and aberrant group of spiny-finned fishes is typically represented by the coffer-fishes or trunk-fishes (*Ostraciontidæ*) and file-fishes (*Balistidæ*) of the tropical seas, the former of which are protected by a complete bony panoply composed of large and for the most part hexagonal plates.

Both the spiny dorsal and the pelvic fins have disappeared, as they would be quite useless to species which crawl about on the sea-bottom in shallow tropical seas. Their typical representative is the coffer-fish (*Ostracion quadricornis*), which, in addition to the bony plates, carries a pair of spines in front of the eyes, and a second, backwardly projecting pair some distance in advance of the anal fin.

There are about a score of species of these strange fishes, allied to which are others constituting the genus *Aracana*, distinguished from *Ostracion* by the bony panoply being open behind the anal fin. In these fishes the front teeth coalesce so as to form a kind of parrot-like beak, but in the file-fishes (*Balistidæ*) they remain separate and have the form of ordinary incisors. Although pelvic fins are lacking, or reduced to a single spine, the spiny front dorsal fin is retained. The typical file-fishes, or trigger-fishes (*Balistes*), some of which grow to a yard in length, frequent coral-reefs, breaking off fragments of branching corals for food with their powerful front teeth, and likewise nibbling at shell-fish, especially pearl-oysters. The allied genera are *Monacanthus* and *Aluteres*, which are likewise tropical and subtropical.

Triodon bursarius, of the Indian Ocean, alone represents a family (*Triodontidæ*) in which the teeth form a beak, those of the upper jaw being divided by a median groove, while those of the lower jaw are completely united; this peculiar arrangement giving rise to the name of these fishes. Both the front dorsal and the pelvic pair of fins are lacking.

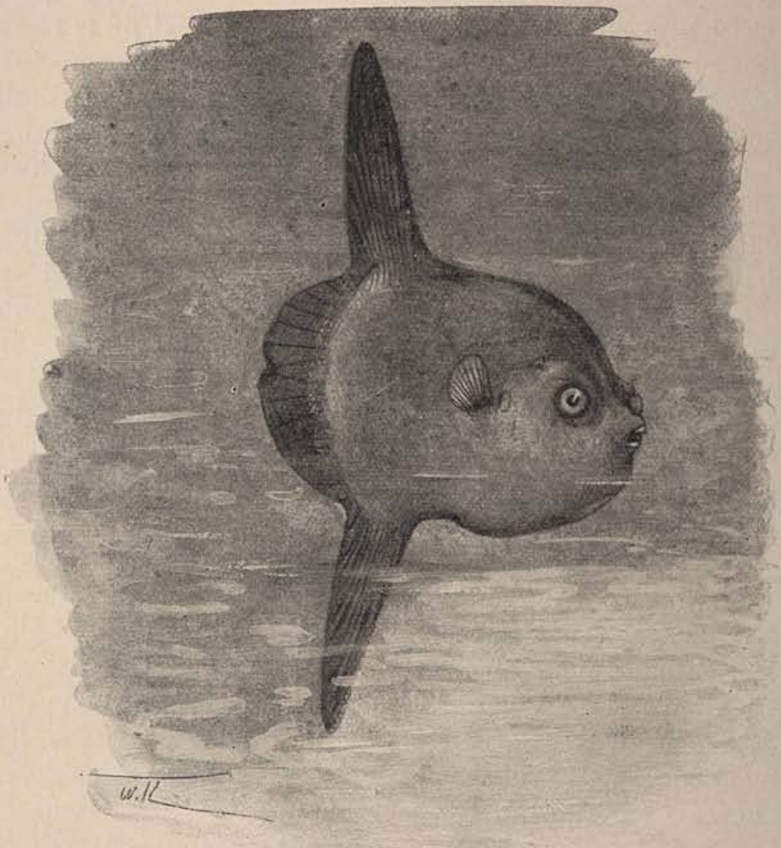
Globe-Fishes and Porcupine-Fishes.

Akin to the foregoing are the tropical globe-fishes and porcupine-fishes of the families *Tetrodontidæ* and *Diodontidæ*, in both of which the teeth form parrot-like beaks, while pelvic and the front dorsal fins are wanting. The globe-fishes, as typified by the genus *Tetrodon*, take their technical name from the retention of a median division between the upper and lower teeth of both sides, and have the skin naked, covered with spines, or, more rarely, protected by bony plates. They can pump air into the lower half of the body, and when in this balloon-like condition float helplessly, back-downwards, on the surface of the sea. A few have taken to a fresh-water existence. In the porcupine-fishes (*Diodon*), on the other hand, the upper and lower teeth of opposite sides are respectively fused completely together, and the body is invariably protected by spines, which in some cases are of considerable length. These remarkable fishes, which feed on corals and molluscs, have likewise the power of converting themselves into living balloons.

Sun-Fishes.

Although very different in appearance, the gigantic sun-fishes of the family *Molidæ* are cousins to the porcupine-fishes, having the upper and lower teeth completely soldered into a beak, although they cannot inflate the skin of their bodies. Their strange truncated form is too well known to need description, and it will suffice to mention that while the lesser sun-fish (*Ranzania truncata*), in addition to its curtailed hind region, has a smooth skin with embedded hexagonal plates, the typical species (*Orthagoriscus mola*) has a rough, granulated skin. These fishes are met with in all the warmer seas, especially near the equator, and occasionally straggle so far north as the British Isles. The typical species may grow to as much as eight feet in length, and weigh as much as 1800 lb.

Flute-Mouths. Leaving the spiny-finned group, attention may be directed to the curious flute-mouths of the family *Fistulariidæ*, of which a well-known representative is the tobacco-pipe fish (*Fistularia tabaccaria*), distinguished, in common with its relatives, by the tube-like muzzle, terminating in a narrow mouth. This fish, which grows to a couple of yards in length, is a native of the tropical Atlantic. The allied trumpet-fish (*Centriscus scolopax*), characterised by the long, tubular snout and the large size of the second dorsal spine, inhabits the Mediterranean, the tropical Atlantic, and the coasts of Tasmania. Red above and silvery beneath, this curious fish measures only about five inches in length.

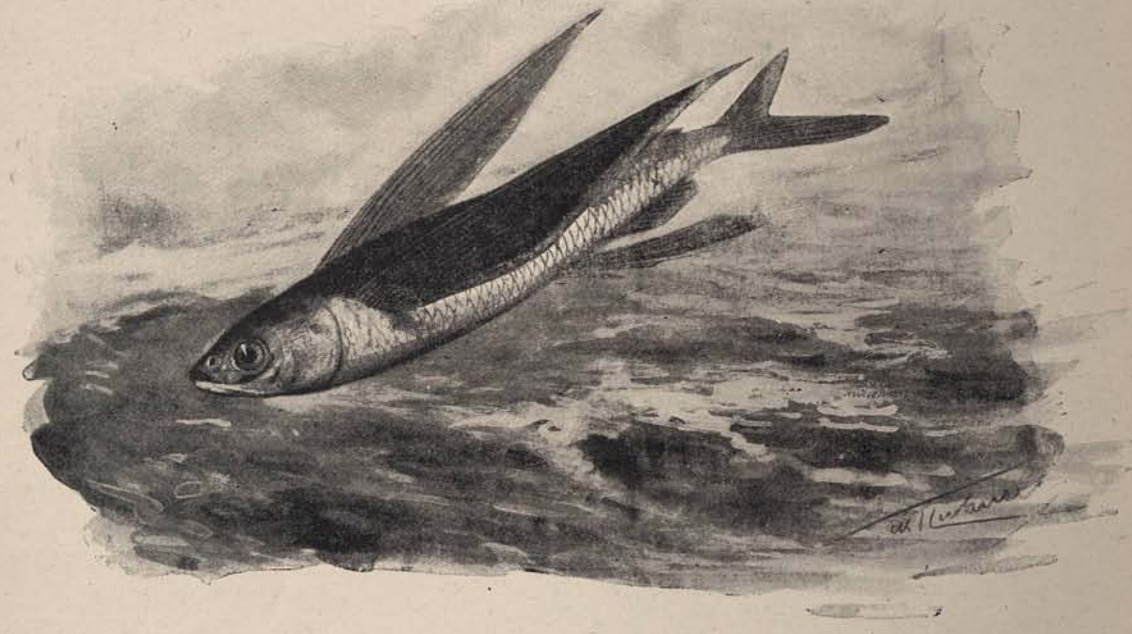


LESSER SUN-FISH.

Pipe-Fishes and Sea-Horses. An allied group, the *Syngnathidæ*, is formed by the pipe-fishes or needle-fishes of the genera *Siphonostoma* and *Syngnathus*, and the grotesque sea-horses (*Hippocampus*) remarkable for their crested heads. The pipe-fishes, of which *Syngnathus pelagicus* is a well-known example, are greatly elongated fishes, protected by an armour of bony rings, with a long, tube-like muzzle, very small, if any, pectoral fins, a long, low dorsal fin, and a tassel-like tail-fin. All these fishes are remarkable for their peculiar breeding-habits. In the Florida pipe-fish (*Siphonostoma floridæ*) and its relatives, for instance, the ripe eggs are transferred from the oviducts of the female to a special brooding-pouch on the under side of the abdomen of the male. In the case of the Florida species, when the eggs are ready for transference, the male and female fishes swim round and round one another for a time, and then intertwine their bodies in the form of a double letter S, with the heads of each turned outwards. In this position the eggs are transferred from the ovary of the female to the pouch of the male when the two are in contact, about a dozen eggs being received in the pouch where they are presumably fertilised. The male then performs a series of evolutions for the purpose of shaking down the eggs into the end of the pouch, on the completion of which the process of transference is resumed. The eggs, which soon become fixed to the pouch, are hatched in ten days. To bring about the shaking down process the male stands nearly vertically, and, resting his caudal fin and a small part of the tail on the bottom of the sea, bends backwards and forwards, and twists his body spirally from above downward. This is repeated until the eggs have been moved into the posterior end of the pouch, when the process is continued until the pouch is filled. Of the sea-horses, the general appearance of which will be sufficiently familiar to most readers, the typical *Hippocampus antiquorum* has a very wide range, occurring in regions as widely sundered from one another as the British Islands, Japan, and Australia.

SEA-HORSE.

Gar-Pikes. Among members of a distinct group, the so-called Percesoces, reference may be made to the gar-pikes of the family *Scombresocidæ*, of which the European representative is *Belone vulgaris*. In calm weather this pike-like fish may often be seen disporting on the surface, leaping from wave to wave in much the same manner as its relative the skipper (*Scombresox saurus*), from which it differs by the possession of finlets. This leaping habit culminates in the flying-fishes of the genus *Exocoetus*, as typified by the ordinary *E. volitans*, in which the pectoral fins are so elongated and expanded as to serve the purpose of wings. **Flying-Fish.** Of these well-known fishes there are more than a couple of score of species, distributed all over the tropical seas, and occasionally straggling into the English Channel. They average about one foot in length, and generally associate in shoals. When flying, they always start from the crest of a wave, out of which they shoot like arrows; but how the flight is performed is a matter which has given rise to much difference of opinion. In reviewing the question whether flying-fishes—which, as previously stated, belong to two distinct groups, the flying-herrings, or true flying-fishes, and the flying-gurnards—really use their 'wings' after the manner of bats, or whether such wings merely serve the same purpose as the flying-membrane or parachute of the flying-squirrels, a foreign naturalist, in the case of both groups, denies that the wings are ever used as instruments of active flight. As regards the former group, this opinion accords with one long held by the majority of competent observers. In regard to the flying-gurnards it has, however, been stated that these fishes differ from the members of the former group in that the wings are moved rapidly during the course through the air, thus producing a mode of flight recalling that of many grasshoppers. This assertion is, however, controverted by the naturalist referred to, who urges that such



FLYING-FISH.

movements as take place in the wings of flying-gurnards are similar in their nature to the vibrations which are admitted to occur in those of the flying-herrings or true flying-fishes. This author summarises the whole case by stating that it may be taken as certain that the initial impetus by means of which flying-fishes of both kinds launch themselves is due to powerful screw-like movements of the tail-fin. The wings are in no sense propelling organs, but act simply as parachutes.

This opinion has been disputed by an English writer, who maintains that the ordinary 'aeroplane-theory' of the flight of these fishes is based on an absolute mechanical impossibility, and that the real explanation is to be found in intensely rapid vibrations of the wing-like pectoral fins—vibrations which are revealed to the eye when the movement slows down as the fish touches the crest of a wave.

Grey Mullets.

Another family of the Percesoces is formed by the well-known grey mullets, *Mugilidæ*, so highly esteemed as food-fishes. These form a widely distributed group, chiefly characteristic of temperate and tropical seas, although a few frequent brackish waters. Among them, the common grey mullet (*Mugil capito*) ranges from the North Sea to the Cape of Good Hope.

Thread-Fins.

Nearly allied are the members of the family *Polynemidæ*, as represented by *Polynemus* and two other genera. These fishes are characterised by bearing a tuft of whip-like appendages a short distance in front of and below each pectoral fin. They inhabit the shores of tropical seas, and frequently enter estuaries in the muddy waters of which the long, freely movable pectoral fins apparently serve as organs of touch; and it is probably by their aid that these fishes are enabled to find their way and obtain their food. The second genus is represented by *Pentanemus quinquarius*, in which the pectoral appendages exceed the body in length. Some of these thread-fins attain a length of four feet, and they are all valued alike as food, and for the isinglass yielded by their air-bladders.

Barracudas.

Another family of the same group, the *Sphyrænidæ*, includes the large, elongated, subcylindrical fishes of voracious habit commonly known as barracudas, all of which are furnished with a series of powerful conical teeth. There are nearly a score of species, among which the ordinary barracuda (*Sphyræna vulgaris*) of the Mediterranean grows to four feet, but some of the other kinds attain double this length.

Parasitic Fishes.

In a different group the curious little fishes of the family *Fierasferidæ*, especially of the genus *Fierasfer*, are of interest on account of their habit of infesting the breathing-chambers of sea-cucumbers, or holothurians, and other invertebrates, where they subsist on such organisms as come within their reach. Beyond sharing the food-supply, they appear, as a rule, to do no damage to their involuntary hosts; but one species, *F. vermicularis*, in its larval state at all events (when it has no pectoral fins), has been stated to feed on the viscera of the holothurians in which it takes up its abode. The family includes about half a score of small species, distributed over the Pacific, Indian, and Atlantic Oceans, and also entering the Mediterranean. An American naturalist has described the manner in which *F. affinis* effects an entrance into the body of the sea-cucumber, which serves as its host. When the small pellucid fish comes alongside of the holothurian, it gradually feels its way down the body of the latter by means of its head until it reaches the vent, when it immediately curls itself into a loop and thrusts the tip of its whip-like tail into the aperture. When this is accomplished, the fish straightens itself, and proceeds leisurely to insinuate itself, tail-first, into the body of its host, the action being apparently assisted by the spines of the dorsal and ventral fins. The whole process occupies only about half a minute.

Ox-Eye.

The last family of bony fishes to be mentioned here is that of the *Scopelidæ*, the members of the typical genus of which inhabit the tropical and temperate zones where they come to the surface only at night, remaining in the depths during the day and also in stormy weather. To this family belongs the so-called ox-eye (*Scopelops boöps*) of the Pacific, a fish remarkable not only for its large, goggle eyes, but also on account of the presence of a number of eye-like phosphorescent spots on the head and sides; similar structures being also developed in certain other members of the group.

THE BLUE SHARK.

Sharks.

Among the cartilaginous fishes, mention may first be made of the common blue shark (*Carcharias glaucus*), the largest member of the family *Carchariidæ*, in which the teeth are usually triangular in form, with or without serrated edges, and sometimes provided with a pair of basal cusps. The blue shark, which grows to five-and-twenty feet, inhabits both the Atlantic and Pacific Oceans, representing a genus containing between thirty and forty species. Nearly allied to the *Carchariidæ* are the curious hammer-headed sharks (*Zygæna*, or *Sphyrna*), forming the family *Zygænidæ*, and characterised by the peculiar shape of the head. A well-known representative of a third family, the *Lamnidæ*, is the porbeagle (*Lamna cornubica*), the range of which extends from the North Atlantic to Japan and New Zealand. This shark, which grows to a length of about 9 feet, is of rather stout build, with the oval eyes situated above the sides of the mouth, and carrying numerous formidable rows of spear-like teeth, armed with large basal cusps, in both jaws. The large size of the first dorsal fin, which, like the second, is devoid of a spine, as well as its stouter make, serve to distinguish this species at a glance from the blue shark, which has two small dorsal fins. To the same family belongs the gigantic *Carcharodon rondeleti*, which grows to 30 or 40 feet in length, and is met with in all the warmer seas. Even more widely distributed is the thresher or fox shark (*Alopecias vulpes*), since it also ranges into colder seas, and not infrequently makes its appearance, like the porbeagle and the blue shark, in British waters. The excessive length of the upper lobe of the tail renders it impossible to mistake this species for any of its kindred. Here, too, belongs the remarkable Japanese elfin or ghost shark, originally described under the name of *Mitsukurina owstoni*, but subsequently found to be apparently inseparable generically from the supposed extinct genus *Scapanorhynchus*. This shark is notable on account of a strap-like prolongation from the crown of the head overhanging the upper jaw.

PORT JACKSON SHARK.

Great interest attaches to the small Port Jackson shark (*Cestracion philippi*) and its relatives, of the Indian, Japanese, Australian, and New Zealand seas, on account of their being the sole survivors of a once numerous family, the *Gestraciontidæ*. The typical species is a bulldog-headed shark, marked with vertical blackish bars on a yellowish brown ground. The genus is specially distinguished by the peculiar character of the dentition, the hind portion of which forms an exquisitely beautiful fluted pavement, adapted for crushing the shell-fish on which these sharks feed, while those in the front of the jaws are sharp-pointed recurved cones. The egg-capsules of these sharks are in the form of cones, with two spiral ridges.

A couple of species of so-called basking-sharks, *Cetorhinus* (or *Selache*) *maximus* and *Rhinodon typicus*, respectively represent two other families of the order. These monstrous sharks take their name from their habit of basking on the surface of the sea, and apparently feed on small fishes and still more minute lower organisms. Both are harmless, and the second, often called the whale-shark is the largest of the whole group, sometimes measuring as much as fifty or even sixty feet in length, while the first-named, or true basking-shark, falls short of this by some ten or twenty feet. The whale-shark is blackish brown in colour, spotted and striped with buff. Both species are armed with quite minute teeth, and have the mouth terminal instead of being situated beneath the head, as in the more typical sharks. In the basking-shark the aperture of the mouth is comparatively narrow, but in the whale-shark it is so wide as to suggest the mouth of a travelling-bag.

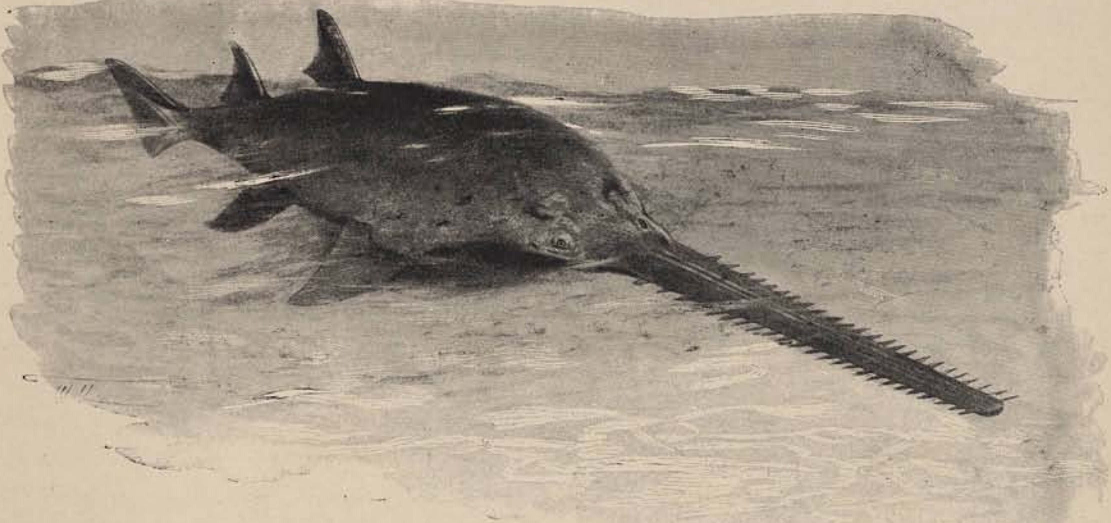
To yet another family belongs the comparatively small shark known as the spiny dog-fish (*Acanthias vulgaris*), which is common to the temperate seas of both the Northern and the Southern Hemisphere, although unknown in the tropics. This, the most common of the European dog-fishes, takes its name from the presence of a bony spine in front of each dorsal fin, and is about four feet in length.

The last sharks which can be mentioned here are the comb-toothed species of the genus *Notidanus*, and the curious Japanese frill-gilled shark, *Chlamydoselache anguineus*, each of which represents a separate family. The comb-toothed sharks take their name from the peculiar character of their teeth, each of which consists of a number of small cusps arranged in a longitudinal line, and gradually decreasing in size from the first to the last. The fringe-gilled shark, on the other hand, is characterised by its elongated, almost eel-like form, and the presence of frill-like expansions on the five gill-arches. The comb-toothed group is widely distributed in the warmer seas.

Monk-Fish. The curious monk-fish, or angel-fish (*Squatina vulgaris* or *Rhina squatina*), is of interest as forming a connecting link between the sharks and the rays. It may, in fact, be described as a ray-like shark, that is to say, a shark with a depressed body and much expanded pectoral and pelvic fins. These singular fishes, for there are several species, are widely distributed in both the Atlantic and the Pacific Oceans, and are believed to subsist largely on flat-fishes of various kinds.

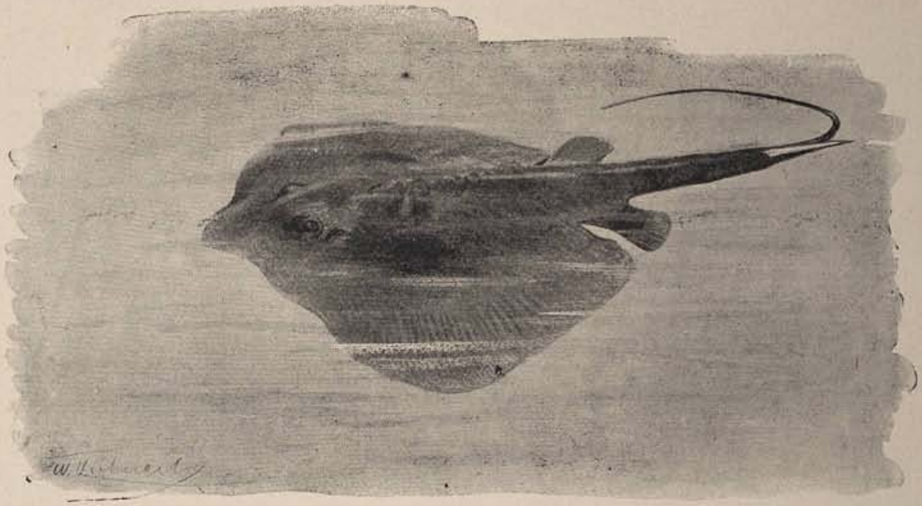
Saw-Fishes. The well-known and formidable saw-fishes of the genus *Pristis* and the family *Pristidæ*, are really aberrant rays distinguished by the prolongation of the upper jaw into the 'saw,' which consists of a long, flat plate of bone armed on each edge with a series of long, flattened teeth set in distinct sockets. In addition to the typical saw-fishes, there is an allied group, the *Pristiophoridæ*, which are more shark-like in character, having the gills laterally placed, as in sharks, instead of being situated on the under surface, as in the true saw-fishes and the rays. The most common representatives of the second of these families are the Japanese and Australian *Pristiophorus japonicus* and the Australian *P. cirrhatus*. Both are characterised by the presence of long tentacles beneath the saw, which are wanting in the more ray-like typical saw-fishes. All the latter attain large dimensions, the biggest being the giant saw-fish (*Pristis pectinatus*) of most tropical seas, which grows to twenty feet or so in length, and is distinguished by bearing a protuberance on the muzzle. Saw-fishes obtain their food by attacking whales and large fishes with sideways strokes of their murderous offensive weapons, by means of which large masses of flesh are hacked off.

Rays. The transition from the monk-fish to the typical rays is accomplished by means of the beaked rays *Rhinobatis* and *Rhynchobatis*, in which the pectoral fins, although large and expanded, do not form such a complete disc as in the true rays, while the body is deeper and narrower, and merges gradually into the larger and thicker tail. The more typical rays, as represented by the well-known European thornback-ray (*Raia clavata*), all of which are too well known to require description, are characterised by the wonderful 'mills' formed by their pavement-like teeth, the structure of which varies in the different genera and families. The more important families include the ordinary rays, *Raiidæ*, the electric rays, *Torpedinidæ*, the sting-rays, or whip-rays, *Trygonidæ*, and the eagle-rays, *Myliobatidæ*. Of these the eagle-rays are the largest and most formidable, especially those of the genera *Dicerobatis* and *Ceratoptera*, in which the head-fins are prolonged into a pair of horn-like processes projecting from the sides of the mouth. These giant rays, or devil-fishes, as they are commonly called, are inhabitants of all tropical seas, among them being the West Indian *Ceratoptera vampyrus*, which may measure twenty feet or more across the disc. These gigantic fishes are much dreaded by the pearl-divers of Panama, who are reported to be occasionally enveloped beneath their great sail-like fins and thus devoured.



SAW-FISH.

All devil-fishes, so far as known, produce only a single offspring at a time; this undergoing its development within the body of the female parent, and attaining a large size at birth. The production of but one young one in this way is a rare condition among fishes, although it also obtains among some of the species of sting-rays (*Dasybatis*). At birth the young of the larger devil-fishes are bigger than full-grown common rays of average size; one taken from the body of an adult female captured at Port Royal, Jamaica, in the year 1824, measuring no less than five feet across the fins, and weighing about twenty pounds. Such a large fish is quite capable of taking care of itself from the time it makes its appearance in the world; and this is doubtless the reason for the production of only a single offspring at each birth. In the case of egg-laying fishes of small size, where no care is taken of the spawn, an immense number of eggs is necessary to ensure the normal number of individuals, but in the case of viviparous fishes a single young one at a time is sufficient to maintain the species at its ordinary level. As a rare abnormality a devil-fish may, however, give birth to twins, although further information on this point is desirable. It has also been stated that a devil-fish taken in the Seychelles was found to be full of eggs. This seems to indicate that these fishes produce a number of eggs, one of which alone undergoes development. Another curious statement is to the effect that a wounded female devil-fish which gave birth to a living offspring was found on dissection to possess a mammary organ which discharged as much as a pailful of milk. This statement admits of a satisfactory explanation as the result of modern investigations, for it has been found that the mucous membrane of the oviduct of the sting-rays secretes a milk-like fluid during the period of pregnancy, which is squeezed out by special muscular arrangements and absorbed by the fœtus by way of the modified first pair of gill-clefts or spiracles; the other gill-clefts being closed at the time. A similar arrangement for the nutrition of the embryo doubtless obtains in the devil-fishes; and the aforesaid statement, which dates from the year 1823, is thus explained. Although the nutritive fluid secreted by the female fish and ingested by the young has considerable resemblance to milk, yet it is chemically different; and as it is absorbed through the head spiracles instead of being taken in by the mouth, it cannot be said that rays suckle their young.



A STING-RAY.

Some of the smaller rays produce quite a number of young at a birth, and in certain instances these differ remarkably in colouring from their parents. An electric ray (*Narcine brasiliensis*) taken some years ago off the coast of Florida gave birth to fourteen young ones, which were spotted as conspicuously as a leopard, whereas in the adult the spots are much less distinct, and in some cases are formed by the agglomeration of pin-like dots. Among the sting-rays and the allied butterfly-rays of the Indian and other tropical oceans, the genus *Trygon* is represented by numerous species such as *T. pastinaca*, which occurs not uncommonly off the British coasts, while *T. sephen* and *T. walga* are much larger Indian species. Severe lacerated wounds are caused by the serrated tail-spines of these rays. Other Indian genera are *Urogymnus* and *Astrape.* Very remarkable is an Indian ray described as *Bengalichthys*, which was discovered a few years ago, and is distinguished from *Astrape* by its thickened and fleshy disc, the rudimentary pectoral fins, and the degenerate eyes. Another genus of rays, *Dactylobatus*, has recently been established, for a species of which two examples were taken off South Carolina a quarter of a century ago. The generic name refers to the presence of a finger-like process jutting from the middle of each pectoral fin, which, together with the subcircular form of the disc, distinguishes this handsomely spotted species from the typical rays of the genus *Raia*.

Chimæras.

Sharks and rays collectively constitute the group Elasmobranchii. Another group of cartilaginous fishes, the Holocephali, differing remarkably in the structure of the skull, is represented by those strange and interesting fishes the chimæras. That they have certain relationships with the sharks and rays is admitted by all, although there is still some diversity of opinion as to the closeness of this affinity. Chimæras, of which the typical *Chimæra monstrosa* is the longest known species, include several genera, and are somewhat shark-like fishes, with blunt muzzles, terminal mouths, large eyes, long, triangular pectoral fins, high first dorsal fins, with a spine in front, short bodies, a whip-like termination to the long compressed tail, and a silvery skin. Their dentition includes two pairs of large, flattened, dental plates above and one below. The genus *Callorhynchus* differs from *Chimæra*, which has been referred to in an earlier chapter, by the presence of a peculiar appendage to the muzzle. Chimæras abound in Japanese waters, where they are represented, among others, by *Chimæra phantasma* and *C. mitsukurii.* Of the former species it is stated that while sometimes the fishermen will catch from twenty to thirty specimens a day in water varying between 50 and 300 fathoms in depth, on other occasions they do not find a single example for days. Although sluggish in their movements when kept in baskets in shallow water (where they soon die), there is reason to believe that in their normal haunts these fishes display considerable activity. Their peculiar egg-cases are larger than those of any other species. Japan is also the home of the long-snouted chimæra (*Rhinochimæra pacifica*) which has been made the type of a genus by itself, although doubts were soon after entertained whether it was generically distinct from a species previously named *Harriotta raleighana*, the first known example of which was taken in deep water near the Bermudas in the year 1905. A second representative of the same genus, *Rhinochimæra atlantica*, is known by a specimen taken off the south-west of Ireland at a depth of between 670 and 770 fathoms. Both these long-snouted fishes difier from the ordinary blunt-headed chimæras by the production of the upper jaw into a long, spear-like beak, and the replacement of the elongated, whip-like tail by a much shorter and deeper caudal appendage; the European species differing from its Pacific relative not only by its much superior size, but likewise by the relatively shorter base of the second dorsal fin. Probably the Atlantic species is not uncommon at comparatively great depths off the Irish coast, where, however, its capture is difficult, five egg-purses having been secured which probably belong to this species. The Atlantic specimen was about five feet in total length—a much greater size than is attained by the typical *Chimæra monstrosa*, of which the normal length is about a yard.

Lampreys.

Lampreys, which, according to modern views, are not really fishes, but form a class (Cyclostomata) of their own, are well represented on the coasts of tropical seas, from which they ascend the larger rivers for the purpose of spawning. Like eels, lampreys never return to the sea from the rivers in which they have spawned; death being probably due to the exhausting effects of breeding, aided perhaps by a reduced vitality brought about by the labour of carrying pebbles in the sucker-like mouth to form the nests in which the spawn is deposited. Disease developing in the self-inflicted wounds made during the breeding season may be another inducing cause. Very noteworthy is the fact that in one Japanese species (*Lapetra mitsurikii*) there are two distinct phases, one very much larger than the other, while in both phases the males differ from the females by the smaller size of the anal fin.

A CORAL-REEF AT LOW TIDE.

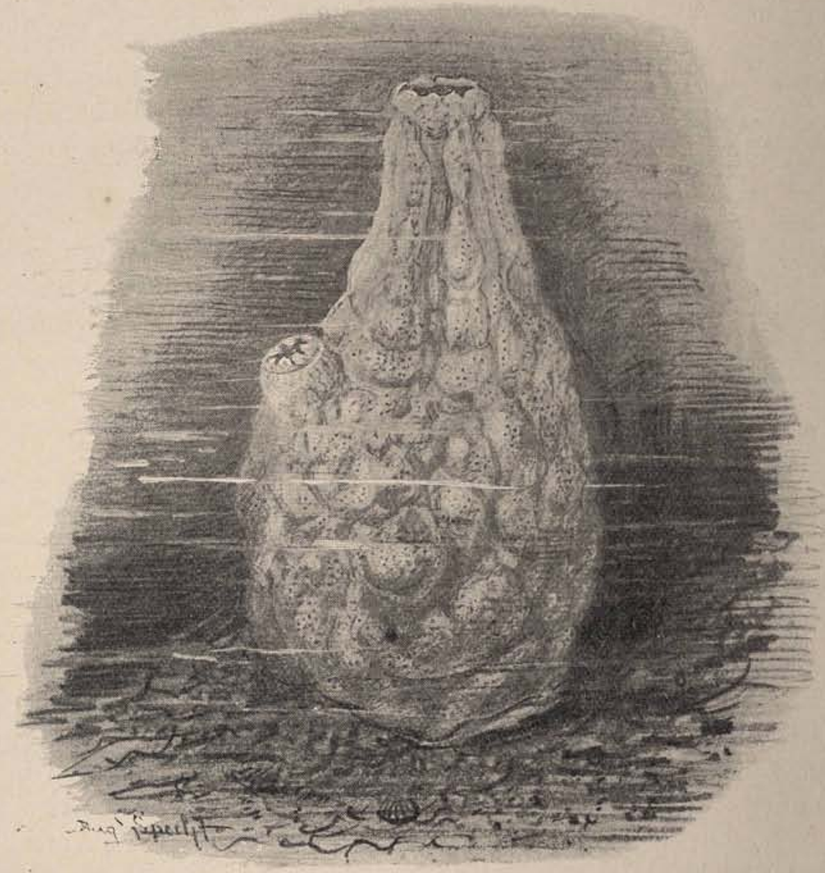
CHAPTER IV

LOWER FORMS OF MARINE LIFE

To give an adequate sketch of the invertebrate life of the ocean within the compass of this chapter is an impossibility; and all that can be attempted is to direct attention to a few—and necessarily a very few—of the more interesting types.

Sea-Squirts.

As constituting a kind of border-land between vertebrates and invertebrates, the so-called sea-squirts, constituting the class Ascidia, or Tunicata, may first claim attention. Looking as they do like animated leather-bottles, and not very highly animated at that, these curious organisms do not suggest much of the vertebrate to the ordinary observer; and, as a matter of fact, it is only in their free-swimming larval condition, when they distantly recall tadpoles, that sea-squirts show any indications of community with the vertebrates, this being displayed by the possession of vestiges of the rod of cartilage running along the back, to which the name of notochord has been applied. In this passage from an active to a passive, and to a certain extent degenerate mode of life, sea-squirts display a feature common to several groups of invertebrates, such as barnacles and oysters. On the other hand, there are certain organisms, such as the feather-stars, which, in place of taking to a kind of arm-chair existence, do just the reverse of this, and are free swimmers only when adult. It should be added that a few of the sea-squirts do not adopt this sedentary mode of life, but are permanently free-swimming. Typically the sedentary adults are in the form of leathery or cartilaginous bags, fixed by the lower end to rocks or the sea-bottom, and with one aperture at the summit and a second on a protuberance about one-third down one side; the upper aperture being for the intake of sea-water, and the lower one for its exit. There are, however, various departures from this type, some kinds forming fleshy coatings on seaweeds or rocks, others solid fleshy masses, while yet others may be free-swimming and barrel-shaped, in some instances united together into chains or hollow cylinders. The ordinary *Ascidia mentula,* which may be taken as a very typical representative of the class, lives on muddy bottoms, and measures about four inches from base to summit. At low tide, when undisturbed, both apertures of the outer bag are open and maintain a constant current of water through the interior of the organism; but when disturbed they are suddenly closed, jets of water being squirted out as the closure takes place. With regard to the internal structure of these strange organisms, it may be mentioned that the upper part of the gullet, or pharynx, is dilated into a huge



A SIMPLE SEA-SQUIRT.

lantern-like breathing chamber, which, except for one line of attachment, hangs freely within the coat situated just inside the outer bag.

The above-mentioned *Ascidia mentula*, which represents the simple type of tunicate structure, is hermaphrodite, and produces floating eggs, which ultimately develop into the free-swimming tadpole-like larvæ to which reference has already been made. *Ascidia mammillata*, the species represented in the accompanying illustration, is another member of the same section. Compound ascidians consist of a number of minute sea-squirts aggregated together into a gelatinous mass which encrusts seaweeds or rocks; *Botryllus violaceus* being an example of this section. In some cases the units of such a colony are joined into groups, the discharging orifices of all the members of which coalesce to form a common outlet. Strangest of all are the hollow, cylindrical colonies of the genus *Pyrosoma*, in which all the inhalent apertures are arranged on the outer and the exhalent ones on the interior surface; these apertures in this instance being situated at the two poles of the constituent individuals instead of being placed near together. The whole cylinder is open at one end and closed and truncated at the opposite extremity. These ascidians, which are represented by about half a dozen species, varying in length from a few inches to as much as four feet, are, as their name (*pyrosoma* = fire body) implies, brilliantly luminous at night, emitting a green light, which may be visible for miles in regions where the sea is swarming with them.

Lastly come the free-swimming forms represented by the barrel-shaped types known as *Salpa* and *Doliolum* and their allies. Salpas are so transparent that they can seldom be detected in waters where they are present in multitudes. They swim in jerks, taking in at each inspiration numbers of the minute organisms constituting the so-called plankton of the ocean surface, which form their nutriment. The most remarkable peculiarity connected with their life-history is that salpas exhibit the phenomenon of alternation of generations, that is to say, a certain individual resembles its grandparents, while individuals of the intermediate generation are of quite a different type and like the great-grandparents of the first individual.

Acorn-Worm, etc.

Another group on the borderland between vertebrates and invertebrates is typified by the acorn-worm (*Balanoglossus*), an organism living buried in the sand or mud of the seashore, and exhaling a strong odour of iodoform. It secretes a sticky slime to which particles of sand and shell adhere, thereby forming a protective tube. A long and sensitive retractile proboscis, somewhat recalling in appearance the flower-rod of the common wild arum, and of a bright orange-yellow colour, forms the upper end of the animal, behind which is a kind of collar, overlapping the proboscis in front, and part of the slits of the gills behind, and also concealing the mouth. Behind this, again, comes the proper body of the animal, invested in its protecting tube, which may be as much as a yard in length. To describe this is unnecessary on this occasion, and it will suffice to mention that the gill-slits present a striking resemblance to those of the lancelets (to which reference has been made in an earlier chapter), and that it also contains structures corresponding to the notochord and the nerve-tube of vertebrates. The acorn-worm is a native of the northern seas, but a second species of the genus occurs in New Zealand. An allied genus, *Harrimania*, inhabits the coasts of Alaska, and is considered to be the most primitive member of the group. Instead of burrowing like *Balanoglossus*, this species lives under stones, where it often makes its way through the mud at the place of contact between it and the stone beneath which it is concealed. While some examples have been found at extreme low tide, others occurred much nearer high-water mark than is the case with any other members of the group. There are several other allied genera, which collectively constitute the ordinal group Enteropneusta, which forms a section of the higher group or class known as Hemichordata. A second group, Pterobranchia, of equivalent rank to the Enteropneusta, is represented by two genera, *Cephalodiscus*, ranging from the Antarctic and the Straits of Magellan to Borneo and Japan, and *Rhabdopleura*; but for an account of these the reader must be referred to more technical works. It may, however, be mentioned that the genus *Cephalodiscus* has a somewhat curious history. It was first described in 1876 from specimens collected by H.M.S. *Challenger*. In 1905 a new species from the Antarctic was named *C. nigrescens*; and in 1912 it was discovered that specimens collected during the voyage of the *Erebus* and *Terror* under Sir James Clark Ross in 1841 or 1842, and preserved in the British Museum, are apparently referable to this species.

Phoronis.

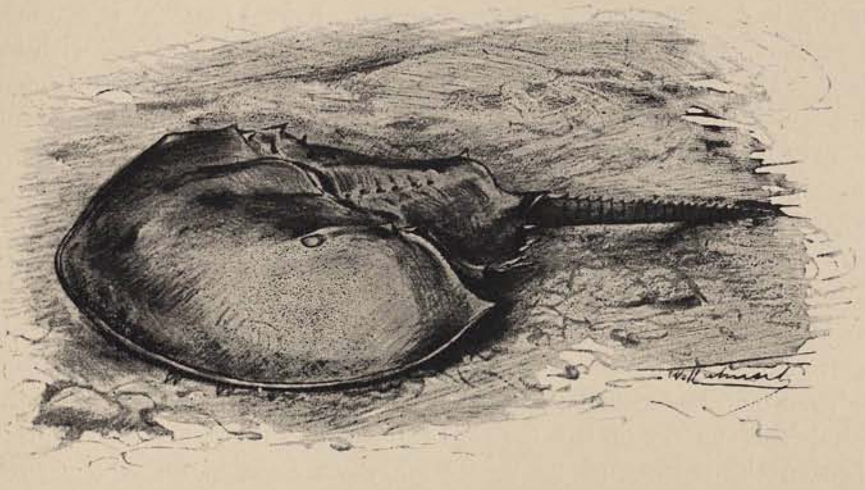
A third order of hemichordates, the Phoronidea, has been made for the reception of the remarkable organism known as *Phoronis*, which is, however, classed by some naturalists with the worms. *Phoronis* is a sedentary animal living in tubes aggregated into colonies, the inhabitant of each tube being, however, completely isolated from its neighbours. The largest species is *Ph. australis*, which grows to a length of six inches, and lives in communities of a score or more individuals, in the substance of the outer wall of the tube inhabited by and formed by a species of sea-anemone of the genus *Cerianthus*. The mouth of the delicate transparent tube of each worm opens on to the outer surface of the anemone, which thus lives alone within its own tube, where it stretches forth its tentacles in all directions from its mouth above the purple *Phoronis* living on the wall. In addition to *Ph. australis*, a second species, *Ph. psammophila*, is found in Port Jackson, as well as in the Mediterranean. The typical *Ph. hippocrepis*, so named from the horseshoe form of the tuft of tentacles, was, however, first discovered at Ilfracombe.

Pycnogonids.

A small group of jointed marine animals, some of which, in their long, slender limbs, recall harvest-spiders, form a group known as the Pycnogonida or Pantopoda, and are believed to represent a very abnormal section of the Arthropoda. They may be found alike under pebbles on the shore between tide-marks and at comparatively great depths in the ocean itself, frequently in vast numbers. The typical *Pycnogonidum littorale*, which may often be found clinging to large anemones, on which the members of the genus are parasitic, is a curious-looking squat creature, with a jointed, rod-like body, and four pairs of thick, jointed, and terminally clawed legs, supported on lateral pedicles; while the head terminates in a long, tubular, sucking mouth. A very different type is, however, presented by *Nymphon stroemii*, in which the slight body is carried high above the ground on long slender legs somewhat like those of a harvest-spider. In the males some of the legs are shorter than the rest, and are used for carrying the capsules of eggs produced by the females.

If kept in cold water, the members of the genus *Nymphon* flourish in aquariums. All of them crawl, but a few are also able to swim by the aid of swimming-hairs, which are more strongly developed in males than in females. They feed entirely on the polyps of Hydrozoa, more especially those of the family *Campanulariidæ*, the mode in which these organisms are seized and devoured being very curious. The species of *Pycnogonum*, which, as already mentioned, are parasitic on sea-anemones, the juices of which they suck, are much more difficult to keep in confinement.

Sea-Spiders. The beach, let alone the sea itself, might at first sight be regarded as a highly unpromising situation for spiders, yet as a matter of fact representatives of the Arachnida are to be found both on the shore and the open sea. On the rocks and coral-reefs of the Indo-Pacific there are to be found, for example, representatives of a group of web-spinning spiders constituting the family *Desidæ*. When the tide comes in, these sea-spiders retreat to holes where they remain in safety till the next ebb, protected by waterproof-sheets of their own manufacture. With the ebb they once more commence to hunt along the shore or to swim in the tide in search of the minute crustaceans and fishes upon which they feed. There are also numerous kinds of truly marine spiders, some of which live at considerable depths, and attain to very large dimensions, measuring in certain instances as much as a couple of feet across the body and legs.



AMERICAN KING-CRAB.

King-Crabs. The so-called king-crab of the Moluccas is a misnamed creature; for, in spite of its somewhat crab-like shell, it is not a crab at all, but rather a near relative of the scorpions, which are first cousins of the spiders, and are consequently included in the class Arachnida—a group of equal rank with the Crustacea or crabs, lobsters, etc.

King-crabs are protected by a capacious buckler-shaped shell, beneath which the six pairs of limbs are completely concealed; posteriorly the body ends in a long spear-like spine, by means of which the animal is enabled to elevate the hind part of its shell while engaged in burrowing into the mud with its limbs. The aforesaid *Limulus moluccanus* is the longest known representative of the group, although the most curious species is the Chinese *L. longispinus*, in which the shell is armed with a formidable array of spines. The species shown in the illustration ranges from Maine to Yucatan. It has been proposed to split the group into several genera, and to replace the name *Limulus* by an older one.

Crabs and Lobsters.

The Crustacea form a most numerous tribe, in which the genera are to be counted by hundreds and the species by thousands; for in this great class are included a vast number of the small organisms forming the plankton of the surface of the ocean, which supplies food to the Greenland and several other species of whales. Crabs and lobsters, to which alone among the more typical groups reference can be made in this place, are excessively fertile animals, as is demonstrated by the following estimate of the rate of propagation of the ordinary lobster and crab on the British coasts. As regards the number of eggs borne by the females of the two species, it is estimated that while the berried crab (*i.e.* the fertile female) carries on an average about 1,000,000, the female lobster has only about 40,000. In both instances the number increases with the size of the individual. Newly spawned lobsters have been taken in July and August, which indicate that the spawning-season lasts from the middle of July to the middle of September. On the other hand, crabs spawn from November to January, or possibly the beginning of February. From July to September has been given as the hatching-season of the lobster, and this tallies fairly with Northumbrian records, the lobsters hatching on that coast chiefly between the end of June and the end of August, so that from June to August or September may be given as the season. Crabs are somewhat later, their hatching-period lasting from July to August. Accordingly, while the eggs of the lobster take about eleven months to incubate, those of the crab hatch out in about eight months. When hatched, the fry of the lobster at once betakes itself to a purely pelagic existence on the surface of the ocean, where it remains for about three weeks, undergoing during this period four moults and acquiring some of the characteristics of the adult. At the end of the three weeks the young lobster takes to the bed of the sea. Information with regard to the early history of the young crab is incomplete, but it seems to pass about a month (with four changes of coat) in the so-called zoea stage, after which there is another intermediate stage before the fry takes on a distinctly crab-like appearance and sinks to the sea-bed.

Female lobsters are mature when about ten inches in length, and to reach these dimensions apparently takes about four or five years. Young crabs of an inch to an inch and a half in diameter are probably about a year old, and the females are about five years when they commence to spawn, at which date they are usually from five to five and a half inches in diameter. As regards seasonal migrations, it appears that crabs leave the coast for deeper water in the autumn; the same individuals generally returning to the shore during the spring, although a certain number depart from their original haunts to find a new home on another part of the coast, which is always northward. The winter migrations of the lobster are less marked, few going far from the inshore ground, where those with eggs remain throughout the season; nevertheless, a few are taken far out to sea. The mortality of lobsters during development and growth is tremendous. It is estimated, for instance, that only one out of every 38,000, or ·003 per cent., attains maturity, this being about one for every berried female. In the case of crabs the mortality is even greater, the estimate being that one adult survives out of every 900,000 fry, or about one for each female with eggs.

Crabs are most numerously represented in tropical seas, where they attain their maximum development both in size and in brilliance of colouring. The largest member of the whole class is the great spider-crab (*Macrochira kæmpferi*) of Japan, in which the shell measures fifteen inches in length, while the longest pair of limbs of the male may reach, when extended, to a span of more than ten feet. The largest shell is, however, that of the Australian giant-crab (*Pseudocarcinus gigas*), which may measure as much as two feet in width. Another large and striking Indo-Pacific species, belonging to the long-tailed group, is *Scylla serrata*, which on the coast of Natal lives in deep holes, where it sits at the entrance to feed as the tide comes in, while at the ebb it basks in the sun, when it falls an easy prey to the spears of the Kafirs. Smaller, but quite as brilliantly coloured, is *Charybdis cruciata*, in which the yellow shell bears in the centre a white cross on a scarlet patch. Among other conspicuous forms, mention may be made of the widely distributed *Podophthalmus vigil*, in which the large eyes are mounted on unusually long stalks, while the shell is expanded into the shape of a spatula; and the New Zealand crayfish (*Palinurus tumidus*), which is a couple of feet in length, and more than seven inches in diameter. The European lobster (*Astacus*, or *Homarus*, *vulgaris*) may attain a weight of eleven or twelve pounds.

Certain other kinds of animals, such as barnacles and sea-anemones, are in the habit of affixing themselves to the shells of crabs and other crustaceans in order to be carried about and thus obtain a larger supply of food than would otherwise be the case. One of the most singular instances of this symbiosis, as it is called, occurs in a crab originally described from Mauritius under the name of *Melia tesselata*. When first described its habit of holding sea-anemones in its two front claws was not noticed, but this was observed later both in Mauritius and in Ceylon. The crab holds in each claw a small white sea-anemone, which it presents, with the tentacles fully expanded, to every intruder, in 'true boxing attitude.' The ground-colour of the crab is whitish with a rosy flush on the front of the shell, which has also a pattern of black lines. Probably both the crab and the anemones benefit by the association, the latter enjoying increased mobility, while the former shelters and defends itself with the living gloves with which it is provided. The stinging threads of the anemone are probably the active means of defence and offence.

Hermit-crabs (*Pagurus*), it need scarcely be mentioned, protect their soft bodies by becoming tenants of the empty shells of whelks and other gastropods which they carry about as if part of themselves. In New Zealand a hermit-crab (*Eupagurus stewarti*) has been found in some cases inhabiting a massive polyzoon apparently too big for the crab to move; in other cases it sheltered in straight tubes in a *Millepora*, these tubes perhaps having been originally formed round sea-weeds, which subsequently rotted.

Barnacles. Barnacles, which few persons unacquainted with natural history can be persuaded to believe are relatives of shrimps and lobsters, are in reality members of the crustacean order which, like the typical sea-squirts, are free-swimming when young, but when adult either fix themselves head-downwards to a rock or other convenient object and secrete a solid shell resembling in many instances a miniature volcano, with the summit closed by movable bands, or develop a flattened, triangular, many-valved shell supported on a long flexible stalk. The former, or sessile, group is typified by the well-known acorn-barnacles (*Balanus*) and the latter, or stalked, group by the ship-barnacles (*Lepas*); each of these being respectively also the type of a family, namely, the *Balanidæ* and the *Lepadidæ.* Before entering on their fixed stage the free-swimming larvæ undergo certain very remarkable structural stages. The adults of both groups display clear evidence of their crustacean nature by the delicate plumes which sweep at intervals, when the barnacles are active, from between the valves and draw in currents of water; these being the modified legs of the larval form. It is from these plume-like, or hair-like, appendages that the order derives its name of Cirripedia, or hair-footed. The acorn-barnacles of European seas are quite small, but in allied species from tropical seas the shells may be six or eight inches in height, several frequently growing in clusters. The ordinary ship's barnacle, *Lepas anatifera,* derives its second name from the old legend that bernicle geese were hatched from this species. From their habit of attaching themselves to floating timber, the shells of turtles, ships, and other moving objects, these barnacles have acquired an almost world-wide distribution.

Barnacles of one kind or another have occupied almost every available and suitable situation. Certain species, chiefly belonging to the genera *Coronula* and *Tubicinella,* take advantage of the bodies of whales as a basis of attachment, and thereby probably secure a greater abundance and variety of food than their relatives which live on rocks. It has been noticed in connection with the barnacle infesting the southern black right-whale (*Balæna australis*) that were it not for some special provision, the growth of the epidermis of the whale, coupled with the wearing away of the outer layer, would soon cause the parasite to be shed, and, as a matter of fact, this actually takes place with the dead shells. The living barnacle cannot, however, be discarded in this manner, since it dissolves the part of the epidermis with which its skin is in contact at the same rate at which fresh epidermal tissue is formed below. Consequently the layer of epidermis between the barnacle and the true skin never varies in thickness, and the parasite accordingly retains its position, the shell disintegrating at the apex at the rate at which it grows at the base.

Perhaps the strangest situation for these organisms occurs in the species known as *Stomatolepas praegustator,* which inhabits the mucous membrane of the throat of the loggerhead turtle. Although sessile barnacles infest the external surface of turtles and whales, while certain parasitic forms penetrate the integument of their crustacean hosts, no other species is known to possess such a peculiar habitat. *Stomatolepas* belongs to the subfamily *Coronulinæ,* and is nearly related to *Tubicinella* and to *Stephanolepas,* a barnacle found imbedded in the horny plates of the shell of the hawksbill turtle. A few years ago a specimen of the flat-tailed sea-snake (*Hydrus platurus*) was taken off Ceylon with a large bunch of barnacles attached to the end of its tail so as to form a somewhat flower-like cluster. As mentioned long ago by Darwin, barnacles not infrequently attach themselves to marine snakes, but such a remarkable specimen as the one referred to, which was brought alive to the Colombo Museum in 1909, is seldom seen. The barnacles were of two kinds, the one with large white valves and the other with the valves much reduced in size, so that a large portion of the nut-brown body was exposed to view. As the cluster was of large size and considerably wider than even the head of the snake, it must have formed a very serious hindrance in swimming, and thus considerably diminished the snake's rate of speed in the water. In this instance the barnacles did not derive any special benefit from their association with the snake, and would have flourished just as well on any other floating or swimming object, but the above-mentioned minute barnacles of the genus *Stomatolepas* are absolutely dependent upon their hosts for food.

It may be added that in New Zealand waters the shell of a crab of the genus *Paramithrax* seems to be almost invariably infested by barnacles (*Balanus decorus*), which are in some cases so numerous and so large as to exceed the crab in bulk.

Nautilus and Cuttles. The three species of nautilus, which must not be confounded with the so-called paper-nautilus, are the sole living representatives of the formerly large and important group of cephalopod molluscs characterised by having four, in place of two, gills, and likewise by possessing the well-known many-chambered shell in the mouth of which are contained the soft parts. The three living species, of which *Nautilus pompilius* is the typical representative, as it also is of the family *Nautilidæ*, are restricted to the tropical and subtropical zones of the Pacific and Indian Oceans, where they live in very deep water. Although specimens of the nautilus with the soft-parts were formerly very rare in collections, it appears probable that the fishermen of certain small islands in the Philippines have been for centuries in the habit of taking nautiluses, which enter their fish-traps at certain seasons of the year in considerable numbers. Hearing of this, an American naturalist made a trip some years ago to Negros Island, where he was successful in obtaining several specimens, and would have got more had his visit been timed at the right season. The traps are sunk in deep water, and the nautiluses enter with the fish. The shells are used locally as drinking-cups or flower-vases, and are sometimes cut into roughly shaped spoons; while they are also bought extensively by Chinese shopkeepers, who export them to China where they are used as material for button-making.

The only other living cephalopod furnished with a true shell is *Spirula peroni*; these delicate little white pearly shells, each coiled into a flat spiral of little more than an inch in diameter, being strewn in thousands on the shores of New Zealand and some of the Indo-Malay islands. Like the nautilus, the spirula represents a family, the *Spirulidæ*, by itself. The complete animal is very rarely obtained; but such specimens as have come under observation show that the shell is internal, with a small portion of its outer margin appearing on each side through the body-wall of the mollusc.

Exception may perhaps be taken to the statement that no cephalopods save the nautilus and the spirula are provided with true shells, since the beautiful basket-shaped shells of the paper-nautilus or argonaut (*Argonauta argo*) form some of the most highly prized treasures of the collector. These beautiful shells are, however, borne by the females alone, and are detachable, and employed solely as receptacles for the eggs, so that they are in no wise comparable to the shells of a nautilus or a spirula, which form an essential part of those molluscs.

Among cuttle-fishes, one of the most notable is the octopus (*Polypus*, or *Octopus*, *vulgaris*), of which the disc may grow to eight or ten feet in diameter, although ordinary specimens are much smaller. Some years ago swarms of octopus appeared on both sides of the English Channel and inflicted untold harm on the crab, lobster, and oyster fisheries. The increase in the numbers of these comparatively scarce cephalopods was first noticed in the spring of 1899, since which date they appeared in such hosts as to justify the application of the term 'plague' to the visitation. The quantity of shell-fish destroyed by these voracious cephalopods is almost incredible. Fortunately the octopus itself is not difficult to capture, and a fisherman can easily account for more than half a hundred per week in the course of his work. On the French coast they are taken and sold for food. The species is figured in the chapter on the Lower Forms of Marine Life in the Northern Seas, on page 303 of the second volume.

The genus *Architeuthis* is noteworthy on account of including the largest known representatives of the entire molluscan class; one specimen, of which a cast is exhibited in the British Museum, measuring no less than thirty feet to the extremities of the single pair of elongated arms with which this frightful creature first seizes its prey. From the evidence of fragments of the limbs this species must, however, be a dwarf to some of those inhabiting the ocean depths. The aforesaid species, *A. princeps*, has a wide distribution, and has been taken off the coast of Ireland. Ordinarily the elongated pair of arms are kept drawn back, but when prey is in sight they are shot suddenly forward, seize the victim with their suckers, and draw it back to be done to death by means of the shorter arms and the cruel, parrot-like beak.

Arrow-Worm.

A certain number of animals are a source of trouble to naturalists on account of the difficulty of assigning them to their proper systematic positions. Among these, is the marine creature popularly known, from its shape, as the arrow-worm, and scientifically as *Sagitta*. In text-books these curious organisms, for there is more than one species, are classed with the worms, but there was an old idea that their real position is among the molluscs. This view has been revived and strengthened by an English naturalist, who places arrow-worms in the Mollusca, next the nautilus and cuttle-fishes.

Univalve Molluscs.

Although shell-collecting is by no means such a fashionable hobby as was at one time the case, few natural objects are of greater beauty and interest than the shells of many of the species of univalve, or gastropod, molluscs. Among the smaller kinds, reference may first be made to the beautiful wentle-traps (*Scalaria*) and violet-snails (*Ianthina*). In the former the white, turriculated shell is ornamented with bold vertical ribs, while in the latter it is snail-like, with the under surface of a rich violet. These violet-snails are pelagic in habit, and in order to enable them to float on the surface, they construct a light raft of air-bubbles, on which the eggs are also carried. In consequence of this pelagic habit, violet-snails are so widely distributed that, although their true home is the tropics, their fragile shells are occasionally cast ashore in countries so remote from one another as the British Isles and Patagonia.

To the same section of gastropods belong the handsome wing-shells of the family *Strombidæ*, of which there are about a hundred species. Among these may be noticed, on account of its size and beauty, the West Indian *Strombus gigas*, a pink-mouthed shell formerly imported into London in immense numbers from the Bahamas for the purposes of the almost extinct art of cameo-cutting. It is this species which yields the rare and beautiful pink pearls. The shells, which attain a length of about ten inches, weigh from four to five pounds; this great weight being due to the fact that the spire and spines of the shell are filled up internally with solid carbonate of lime as the animal increases in age. In the same family are included the curious scorpion-shells (*Pteroceras rugosum*) of the Indo-Pacific, in which the shell is like that of a *Strombus* when young, but with advancing age develops a series of long claw-like projections on the outer margin, the hindmost of which lies close to the spire and forms the posterior channel to the mouth of the shell.

Nearly allied are the solid and handsome helmet-shells, constituting the genus *Cassis* and the family *Cassididæ*. Among these may be mentioned the orange-red bull-mouthed helmet (*C. rufa*) of West Africa, the pale queen-conch (*C. madagascariensis*) of Madagascar and Mauritius, and the black-mouthed *C. flammea* of the West Indies and South America. These shells were likewise formerly in great demand for cameo-cutting; their special excellence for this purpose being due to the fact that there are layers of different colours in the shell, so that by cutting down to the proper layer the background of the cameo is caused to be of different, and generally darker, tint from that of the subject selected for engraving.

The handsome trumpet or triton shells, forming the family *Lotoriidæ*, have taller spires, and a number of vertical ribs for the purpose of affording additional strength. The shells of the great *Lotorium*, or *Triton, variegatum* of the South Pacific are used by the Polynesians and Melanesians as trumpets or horns; a hole, through which to blow, being made in the upper part of the spire. By partially blocking the mouth of the shell with the fingers, variations and modulations can be effected in the notes of these natural trumpets.

Another striking group is represented by the tun-shells of the family *Doliidæ*, which are globose in shape, with short spires and large mouths; the typical *Dolium galea*, of which the shell may measure as much as ten inches in length, being the largest Mediterranean gastropod. In the tropical and subtropical seas the genus is more richly represented. Near akin are the gastropods of the family *Fasciolariidæ*; among these being the largest members of the whole group, the great *Megalotractus aruanus* of the Aru Islands and north and western Australia, and the equally large *Fasciolaria fasciata* from the seas off the coast of South Carolina, measuring in some instances at least a couple of feet in length.

The murexes, *Muricidæ*, form another large family, the shells of many of the members of which are characterised by the length of the channel at the lower end of the mouth and the development of spines of various shapes carried on more or less prominent longitudinal ribs. One of the smaller species with the greatest development of these spines and a long beak is the so-called "thorny woodcock"

(*Murex tenuispina*). Of a stouter type is the Mediterranean *M. brandarius*, one of the species yielding the famous Tyrian purple.

A closely related family is formed by the well-known cowries (*Cypræidæ*), most of which are characterised by the highly polished enamel of their shells. Cowries are recognisable at a glance by the straight and narrow mouth of the shell bearing a number of parallel vertical 'teeth' on the sides and terminating at each end in a deep channel, the lip being turned in, and the spire in adult specimens almost or completely concealed or overlaid with enamel. Among the larger tropical species is the Argus cowry (*Cypræa argus*) of the Eastern seas, which grows to about four inches in length, and takes its name from the rich brown rings on a yellowish ground. In the dark and handsome Mauritius cowry (*C. mauritiana*), ranging from the island from which it takes its name to Christmas and the Cocos-Keeling Islands, the shell is of much broader type, and has the middle of the chocolate-brown upper surface marked with closely approximated paler spots, which are in some cases distinct, but in others tend to run together. Of a similar type, both as regards shape and colouring, is the snake's-head cowry (*C. caput-serpentis*), in which the spots are relatively smaller and more thickly crowded. Another beautiful type is presented by the large and handsome tiger cowry (*C. tigris*) of the Indian Ocean. The shell is marked by a nearly straight reddish brown longitudinal line, indicating the margins of the fleshy mantle by which it is covered when the soft-parts of the animal are protruded, on either side of which are a number of large indistinct blackish brown spots and blotches on a bluish white ground. Of somewhat similar shape and size is the handsome orange cowry (*C. aurantiaca*) of the tropical Pacific, so called from its uniformly rich orange shell, which formerly commanded a very high price. An altogether different type occurs in the well-known money cowry (*C. moneta*), of the Indo-Pacific, in which the shell is an inch or less in length, with an irregular surface and a yellowish colour. In common with the somewhat longer and more regularly formed shells of the ring cowry (*C. annulus*), which are also cream-coloured with an orange ring on the upper surface, money cowries were formerly used extensively as a medium of exchange in India and the islands of the Pacific, as well on the west coast of Africa, to which they were imported in large quantities. One small species, *C.* (*Trivia*) *europæa*, in which the vaulted shell is marked with fine parallel transverse ridges and grooves, and is of a fleshy pink colour, is not uncommon on the coasts of Britain and other European countries, but bears no comparison in point of beauty to its tropical relatives. The shuttle-shell (*Radulus volvula*), belonging to the allied family *Ovulidæ*, is remarkable for the production of the two ends of the mouth into long, beak-like channelled processes. These and other species of the same genus live on the so-called bark-corals of the family *Gorgoniidæ*, some of the smaller kinds harmonising in colouring with the particular gorgonias on which they take up their quarters.

To a different group belongs the curious *Magillus antiquus*, of the Indian Ocean, which in the young state is free and not unlike a periwinkle in shape, but eventually takes up its home in a coral-reef, where it forms as an extension of the mouth of its shell a long irregular, white calcareous tube which continues to grow at the same rate as the coral. As the original shell and the lower portion of the tube become buried in the coral they are filled up with solid shelly material, the soft parts of the mollusc being contained in a cavity at the top of the tube.

Of a more normal type are the dog-whelks, the shells of one of which, *Nassa callosa*, when cut into transverse sections form the dewarra-money of New Britain that passes current at three shillings a fathom. To another family belongs *Turbinella rapa*, the famous chank-shell carried by the images of Vishnu, the Hindu deity, of which the left-handed variety is held sacred. This shell comes chiefly from Tuticorin, in the Gulf of Manar, where the licences paid by the divers used to bring in a revenue of £4000 a year to the Government of Ceylon. To the allied family, *Buccinidæ*, of which the common whelk (*Buccinum undatum*) and the red whelk (*Fusus antiquus*) are well-known British representatives, belongs the unicorn-shell (*Latirus cingulatus*), characterised by the presence of a long tooth-like process on the centre lip of the shell. It is a general belief that whelks (under which term may be included a number of genera of solid-shelled molluscs belonging to the families *Buccinidæ*, *Nassidæ*, and *Muricidæ*) obtain access to the interior of the oysters, mussels, and other bivalves which form their food by boring through the shell with their 'chain-saw' tooth-ribbon, and then sucking out the flesh by means of their long proboscis. Such a method of attack has been observed in the case of the little purple-yielding whelk (*Purpura*), of our own shores, but is apparently not followed by the dog-whelk (*Nassa*), which has been seen to wedge its own shell between the gaping valves of the clam or mussel selected as a victim. This latter method of attack is also the one employed by the large American whelks of the genus *Fulgur* and its sub-genus *Sycotypus*. Some of these whelks were kept in a salt-water tank, where they were fed on live oysters, clams, mussels, etc. In the case of oysters the whelk crawled on the top of the bivalve, which closed its valves, only to reopen them after the lapse of a few minutes. Thereupon the attacker inserted part of its own shell in the gap, and immediately after introduced its proboscis. Fifty minutes later it left the empty shell; while after the lapse of another twenty minutes it set about serving a second oyster in the same way. These whelks will eat a couple of oysters one day and as many the next, but after this they fast, and lie buried in the sand. In the case of clams or gapers (*Mya*) no insertion of the shell of the whelk is necessary, as the valves have an aperture, even when closed, into which the proboscis can be inserted. Bivalves of the genus *Venus* are attacked in a different manner; the whelk grasping the bivalve in the hollow of its muscular foot, and then bringing the edges of the valves of the former against the margin of its own shell. By contracting its muscles it forces the margins of the valves together, which results in a small fragment being chipped from one of the shells of the *Venus*. This is repeated till the crack becomes wide enough for the proboscis of the whelk to be brought into play. The insertion may take place either through the flattening out of the proboscis, by the introduction of a secretion which causes the *Venus* to gape, or by the insertion of the shell of the whelk between the valves. The *Venus* is more sensitive to external stimulants than is the oyster, and when once in the grasp of its deadly enemy never opens its valves voluntarily. An oyster, on the other hand, after recovering from the first shock, opens its valves wide, altogether heedless of danger. When opening oysters and clams, these American whelks frequently fracture or crush their own shells, a circumstance which accounts for their frequent irregularity of growth.

Very conspicuous and striking, on account of their scarlet or crimson quadrangular blotches on a pure white ground (when the epidermis, or outer skin, is removed), are the elongated, spiral, long-mouthed mitre-shells of the family *Mitridæ*, among which the species known as *Mitra papalis* is the largest and perhaps the handsomest. In this species, which is a native of the Indian seas, the shell is about five inches in length, and marked with irregular red blotches arranged in diagonal lines.

Very handsome are the capacious shells of some of the volute family (*Volutidæ*), half the members of which are Australian, while the remainder are distributed over a wide area, including the seas of the West Indies, Chile, Cape Horn, West Africa, and Java. The largest of all are the boat-shells (*Cymba*) and melon-shells (*Cymbium*), which are generally yellow in colour, and have smooth surfaces and short spires—which may carry rings of spines—and enormous apertures. The members of these genera are remarkable for producing their young alive, the eggs being hatched within the bodies of the parents, upon which the young are carried for some time after birth. The West Indian bat-volute (*Voluta vespertilio*), which represents the typical genus of the family, is smaller, and has the shell ornamented with dark zigzag markings.

The beautifully polished olive-shells typify yet another family of allied gastropods, the *Olividæ*, the members of which are for the most part tropical in distribution; one of the commonest, and at the same time one of the most richly coloured, being the painted olive (*Oliva ispidula*) of the Indian Ocean. The harps (*Harpidæ*), of which *Harpa ventricosa* is the typical species, form a family by themselves, and, unlike the olives, are characterised by the short-spired, wide-mouthed, and highly polished shells carrying a number of bold longitudinal ridges. The foot is large with deep lateral fissures; and its hind part is stated to be thrown off when the animal is disturbed or irritated, much in the same way as a lizard discards its tail. The shell of *H. ventricosa* has crescent-shaped white spots on a pale lilac ground bordered with brown. Belonging to another section are the cone-shells (*Conidæ*), many of which are amongst the handsomest of univalves. The family is widely spread over the warmer seas; and the shells are conical or fusiform in shape with long narrow mouths and very short spires. One of the most exquisite is the admiral cone (*Conus amiralis*) of the Pacific and Indian Oceans, which measures about two inches in length and is marked with white triangular spots forming a delicate network on a citron-brown ground. The so-called orange admiral is, however, the most beautiful of all the group; while among other lovely species are *C. omaicus*, *C. victor*, and, most valuable of all, *C. gloria-maris*.

To an entirely different group belong the ormers or ear-shells, *Haliotidæ* characterised by their rough exterior and beautifully iridescent nacreous inner surfaces. These, too, attain their maximum of size and beauty in tropical seas; *Haliotis splendens* being one of the finest among the seventy species. Near the outer edge of the shell may be observed a row of perforations through which tentacular processes are protruded in the living state; the presence of these allying the group to the keyhole limpets (*Fissurellidæ*), and so with the rare and beautiful *Pleurotomaria*, the representatives of which have top-shaped shells with a slit running for some distance along the basal whorl. These shells are of extreme beauty, being marked with scarlet streaks and blotches on a cream-coloured ground, and sometimes growing to a large size. They are of great interest, on account of being, like the New Zealand tuatera and the Queensland lung-fish, survivors of an ancient and once numerous group now on the verge of extinction, allied extinct forms being abundant in the Jurassic and Cretaceous rocks of Europe.

Here may be mentioned the chiton-shells *Chitonidæ*, of which the flat shells are unmistakable on account of being formed of a number of parallel, transverse, movable plates, so arranged as to permit the molluscs to roll themselves into a ball. In this case, too, the largest species are tropical. Some of these tropical chitons possess eyes on the dorsal surface of the shell, while all have a canal-system within the shell itself which is likewise sensory in function. The dorsal eyes are of two types, one characteristic of the subfamilies *Toniciinæ* and *Liolophurinæ*, and the other restricted to certain species of *Chiton* itself. It is remarkable that in certain species, especially *Tonicia chiloensis*, the dorsal eyes are attacked, and apparently destroyed, by an alga, which develops within the substance of the shell.

Tooth-Shells.

The tooth-shells (*Dentaliidæ*) constitute by themselves a primary group of molluscs, the Scaphopoda, characterised by the rudimentary head, the long foot, and the tubular shell, open at both ends. They are exclusively marine, and generally live with the hind end projecting from the soft sand or mud of the sea-bottom, near the coast. One of the largest species, *Dentalium elephantinum*, of the Mediterranean, Red Sea, and Indian Ocean, has a shell of more than two inches in length, but in the common European elephant's-tooth (*D. entale*) the shell is half an inch or more shorter, and cream-coloured and smooth, instead of green and fluted. One of the species, *D. indianorum*, raked up from the sand below low-water mark on the coast of north-western America, was used as currency by the Indian tribes until the Hudson's Bay Company substituted blankets in its place.

Bivalves.

Among bivalved molluscs an interesting genus is *Solenomya*, in which the shell in shape resembles the familiar razor-shells, and has a strong horny outer skin. The soft-parts are characterised by the very long tentacles, and the elongated foot terminating in a circular disc. The genus belongs to a group in which the gill-filaments are more or less inclined at a right angle. To a second group, in which these same gill-filaments are parallel, belong the ark-shells (*Arcidæ*), recognisable by the straight hinges of the two shells, with numerous fine, plate-like, interlocking teeth. Ark-shells are almost cosmopolitan in range, although most numerous in the warmer seas. Strange to say, one species, *Arca scaphula*, inhabits the bed of the Jumna, a thousand miles above Calcutta. Closely allied is the genus *Cucullæa*, interesting on account of the fact that while there are only two living species, more than two hundred are found fossil; the present representatives are confined to the coasts of Mauritius, the Nicobars, and southern China. Much the same may be said in the case of the family *Trigoniidæ*, which was believed to be extinct until a specimen of *Trigonia pectinata*, the one living species, was dredged up in Sydney Harbour. That species exists nearly all round Australia; and is of special interest, not only for the antiquity of its genus, but from being one of the few genera in which the beaks of the shell point backwards. Another family comprises the mussels and allied species (*Mytilidæ*), distinguished by their equivalved but inequilateral shells in which the beaks are incurved, and the horny ligament connecting the two valves occupies a groove and is of unusual thinness. Mussels are inhabitants of all seas, from Iceland to New Zealand, and from Alaska to Cape Horn, as might, indeed, have been expected from their anchoring themselves, by means of the adhesive tuft termed the byssus, to the bottom of ships and floating timber (as well, of course, as to rocks and piles), and being thereby carried from one ocean to another. In certain localities the ordinary *Mytilus edulis* is cultivated for food in what are termed mussel-farms while it is also extensively reared for bait.

In an entirely distinct section of bivalves an important position is occupied by the typical pearl-oyster (*Meleagrina margaritifera*) and its relatives, which belong to the family *Aviculidæ*, typified by the so-called wing-shells (a name also applied to the members of the genus *Strombus*). Pearl-oysters, some of which attain large dimensions, measuring as much as ten inches in the longer diameter, are essentially tropical bivalves, and have a wide distribution equatorially. Pearl-fisheries exist in many parts of the tropics, one of the oldest and most famous being the one in the Gulf of Manar, where the pearl-banks cover an area of more than 700 square miles.

The Ceylon pearl-oyster (*Meleagrina fucata*), in which the sexes are separate, thrives best in the open sea at a depth of about six fathoms in place of in intertidal waters. At the present time the Ceylon pearl-banks are practically unproductive; and it seems that there are periodical spells of barrenness, when not a single adult oyster is to be found over the whole area. During such a period the banks may, however, become suddenly replenished and covered in countless numbers with the 'spat' or spawn over several square miles, and the problem awaiting solution is the origin of this presumably foreign spat. Another problem is connected with the disappearance of the oysters, both old and young. Although it has been proved that predaceous fish and boring molluscs have a share in this destruction, there remains a considerable percentage of oysters which die for some unknown reason, although epidemic disease may be the cause. The Ceylon banks are dredged solely for the pearls contained in the oysters, the shells of which are too small to be of much, if any, commercial value. On the other hand, the pearl-oysters of the Japanese and Philippine seas are of large size, and are dredged mainly for the sake of the shells, which form the chief source of commercial mother-of-pearl. In the Philippines there are two kinds of these large pearl-oysters, the golden-lipped *M. maxima* and the black-lipped *M. margaritifera*, of which the former is by far the more valuable; and it is probable that the same two species also occur in Japanese waters. The Philippine oysters are much less prolific in their yield of pearls than the small Ceylonese species; nevertheless Philippine pearls are some of the finest and most beautiful known, so that there could not be a better locality for an attempt to produce pearls by semi-artificial means. For hundreds, if not thousands, of years the Chinese have been in the habit of introducing small rough images of Buddha into the shells of a river-mussel (*Dipsas plicata*), which are then returned to the water until the images are coated with mother-of-pearl, when they are taken out and sold as charms. A modification of the same plan is adopted by the Japanese at the Mikomoto pearl-farm. By means of a small canula, a minute mother-of-pearl bead, flattened on one side so as to lie steady on the shell, is introduced between the valves of a pearl-oyster, which is then returned to salt-water, where it is allowed to grow for six or seven years. At the end of that period the batch of oysters is taken out and examined for pearls. Owing to the large number of oysters thus treated, the industry is profitable, although the pearls are never perfectly spherical, and are also—probably from the nature of the core—deficient in lustre. Several hundreds of people are employed on the 'farm,' and the pearls find a market at good prices. Indeed, some of the so-called antique jewellery offered for sale at Manila has been found to be set with these artificially produced Japanese pearls. The results at Mikomoto leave no doubt that the artificial production of real pearls is not only practicable, but profitable. The aim is, however, to grow spherical, perfect pearls of fine lustre like the best natural ones, and it seems probable that this can be attained only by forming them round a natural nucleus. In the Philippines fully 50 per cent. of these nuclei consist of the larvæ of cestode tapeworms, while in a few instances they consist of eggs, probably of a small crab, grains of sand, and fragments of calcareous sponges, and other organisms. Other large pearl-oyster fisheries are carried on in the Persian Gulf, on the western coast of central America, and off the north-western coast of Australia.

It was formerly believed that pearls were invariably formed round grains of sand and other inorganic substances, but the trend of modern research has been to show, as noted above, that the nuclei generally consist of the larvæ, or more rarely the eggs, of parasites infesting the oysters, the most common of these being worms of the cestode group. Although pearls formed round such nuclei at first lie loose within the valves of the oyster, they do not always remain so, but may become attached to the shells themselves, when they assume various irregular shapes.

Although it is a fact that Ceylon possesses some of the richest beds of pearl-oysters in the world, it is probably little known that it owns another source of pearls. This second supply is derived from the thin-shelled species of oyster commonly known as the window-pane oyster, and scientifically termed *Placuna placenta.* These oysters are found in certain backwaters, or lagoons, in the island, where they are carefully and extensively cultivated for the sake of their pearls. As the interior of the placuna shell does not display the brilliant iridescence of the true pearl-oyster, the pearls obtained from it are probably inferior in lustre to the others.

To the same family (*Aviculidæ*) as the pearl-oysters belong the curious hammer-oyster (*Malleus vulgaris*) of the Indian Ocean, and the wing-shells (*Avicula*), and the various species of the allied genus *Pinna.* In the last of these the valves of the shell are in the shape of an isosceles triangle, and quite translucent. Some pinnas grow to as much as a couple of feet in length, and in life project a foot or more above the sand, in which they are partially buried, moored by the silky byssus to any convenient object.

As representing another large group, mention may be made of the Australian

Ephippodonta macdougalli, which invariably takes up its abode in the burrow of a species of prawn (*Axius plectorhynchus*). When the rock is soft, the prawn drives its burrow straight, but if the ground be hard the burrow is driven into a small mound of sand previously constructed with much labour by the burrower. In either case the hole is lined with soil on which grows an orange-coloured sponge, while on both sponge and soil live the molluscs, which take up little room owing to the flatness of their valves. In these burrows are two species of *Ephippodonta*, and certain other invertebrates which have not hitherto been found elsewhere; their presence being due, perhaps, to the supply of seaweed stored by the prawn in its burrow as a provision against bad times.

Cockles, *Cardiidæ*, as typified by the well-known *Cardium edule*, are represented by more than a couple of hundred species, collectively world-wide in their distribution; on the other hand, their near allies, the clams (*Tridacna*), are restricted to the Indian Ocean, the China Seas, and the Pacific. The shells of these clams are the largest among all bivalves, sometimes measuring a couple of feet or more across, and massive in proportion, with strong vertical ribs. Those of the commonest species, *T. gigas*, are often used as basins for both sacred and domestic purposes; and it was always on one of these shells that the ancient Greeks represented Aphrodite rising from the sea. Some pairs of valves exceed 500 lb. in weight, to which another 20 lb. must be added for the soft-parts. Giant clams grow in large number in the still central lagoons of coral-islands in the Indo-Pacific, and are noticeable for the vivid colouring of their soft-parts, which present a splendid iridescent blaze of blue, violet, and yellow ornamented with various bizarre patterns.

Reference has already been made to the shells of the genus *Trigonia*, noteworthy on account of the beautiful ribbing of the pale purple outer surface, the nacreous interior, and the complicated 'teeth' forming the hinge. These belong to a very ancient family, the *Trigoniidæ*, and in the Australian seas represent a group which abounded in the Oolitic rocks of Europe, where the remains of relatives of the modern Port Jackson shark are likewise found.

Lamp-Shells.

Presenting a certain superficial resemblance to bivalve molluscs, the lamp-shells or brachiopods are so essentially different in their organisation that they constitute a class, the Brachiopoda, by themselves. Although, like bivalve molluscs, they have a double shell, often united by a hinge, its two constituent valves, in place of being right and left, as in bivalves, are respectively back and front, the front or ventral one being usually larger than the other, and furnished with a perforated beak, this giving rise to the name lamp-shell, from a fancied resemblance of this valve to an ancient Roman lamp. In certain species (*Lingula*) the shell is horny and tongue-like, but it is more frequently composed of calcareous spicules. Some lamp-shells are provided with a hinge and an internal calcareous skeleton, but others lack both these structures. Most of them have a pedicle or stalk by which the shell is attached to a rock or other object, this stalk protruding through the perforation in the larger-valve, when such perforation is present. A common species, which has a vertical range of from 5 to nearly 1500 fathoms, is the widely distributed *Terebratula vitrea*, easily recognisable by its whitish translucent ovate shell, of about an inch in length.

Another genus, with numerous species, is the sharp-beaked *Rhynchonella*, in which the shell is ribbed instead of smooth. These two genera are nearly related, but an altogether different type is presented by the horny-shelled *Lingula anatina*, of the Indo-Pacific, which is much larger, and nearly flat, with a long stalk; the colour of the shell being pale green with a banded arrangement. The special interest of the lingula lies in the fact that it represents one of the most ancient generic types in existence; the genus dating, in fact, from the lower part of the Palæozoic epoch, that is to say, from a period (the Cambrian) long antecedent to that during which our coalfields were laid down. These brachiopods live in tubes in the sand in shallow water, the shell occupying the upper portion of the tube, with its aperture just below the surface, while the stalk, which may be six inches in length, fills the lower cylindrical portion; this lower portion being lined with mucus. When frightened, the stalk is contracted and the shell suddenly withdrawn half-way down the tube.

Sea-Mats.

A few lines must suffice for the so-called sea-mats, which are commonly mistaken for sea-weeds, although they are really colonies of polyps of a comparatively high grade of organisation and related to the brachiopods, but representing a distinct class, the Polyzoa or Bryozoa. One of the well-known species is the broad-leaved horn-wrack, or sea-mat (*Flustra foliacea*), which is to be found among the heaps of sea-weed cast up by the tide. On examination with a lens, it will be seen that the surface of the mat is divided into a number of small cells, each of which, during life, contains a polyp; these polyps, when active, protruding a delicate plume of tentacles. When inactive, each cell in this particular genus, although not in others, is closed by a lid. The organism is attached by a stalk to a stone or other object.

Sea-Worms.

Among the countless hosts of marine worms, or annelids, attention must be mainly restricted to the curious palolo worm of Samoa and Fiji. For more than half a century the appearance of swarms of these worms in the sea, apparently always just before the full moon, in October and November, has been familiar, and it has also been known that the worms forming these swarms are always imperfect. It is now ascertained that these palolo are the slender posterior generative portion of the annelid known as *Eunice viridis*, which at the swarming season becomes detached and free-swimming. This portion is very much longer than the proper body of the creature, which is, however, much stouter. The complete worm dwells in coral-reefs, into which it burrows; and, curiously enough, its existence there was quite unknown to the Samoans, to whom the demonstration of its presence by an American naturalist came as a revelation. The worm only attains its full dimensions shortly before the swarming season. Another worm (*Ceratocephale osawai*) at certain seasons appears in swarms in the Gulf of Tokyo and the rivers debouching therein, after the manner of the palolo. Instead, however, of belonging to the *Eunicidæ*, the Japanese species is referable to the *Lycoridæ*. According to the experience of the fishermen, the Japanese 'palolo' swarms during the months of October and November, usually in four periods of a few days' duration each. The swarming season always takes place when the moon is either new or near the full, and invariably occurs in the evening just after flood-tide. On one occasion, the height of the swarm did not last more than a couple of hours, the worms after this apparently sinking to the bottom exhausted.

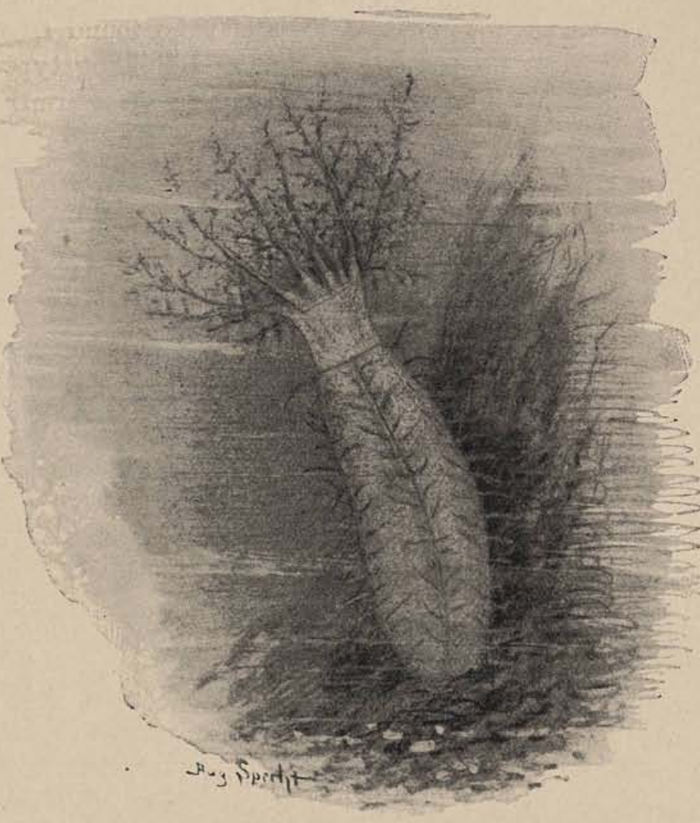
In connection with the swarms of these worms, mention may be made of a remarkable phenomenon seen on the Californian coast a few summers ago. Early in July a red streak was noticeable in the sea off San Pedro Harbour, which during the next few days approached the shore and divided into several patches of many acres in extent. On the 16th the patches reached the shore, where they were the cause of the most unusual display of phosphorescence. This discoloration and phosphorescence of the water were due to the presence of swarms of flagellate animalcules. Four days after the red streak reached the shore, a most sickening odour arose from the water along the beach. During the night, on a beach about 400 feet long, a large number of animals were left by the tide; among them being several hundred holothurians, several specimens of two species of sting-ray, two of beaked rays, two dog-fishes, a red perch, a large number of smelts, and several octopuses. The 'red water' occurred for at least two hundred miles along the coast and extended several miles out to sea; it had not disappeared at the beginning of September. Wherever it occurred food-fishes were scarce, but the small harbour-fishes and invertebrates of the 'plankton' were unaffected. Towards the end of July the animalcule *Noctiluca* appeared in swarms and devoured the animalcules of the red water. A somewhat similar visitation is reported to have occurred five hundred miles farther south in the seventies of the last century.

It may be added that the so-called sea-mouse (*Aphrodite aculeata*), of the British seas, which grows to a length of from three to six inches, and is remarkable on account of its iridescent bristles, is a member of the annelid class, to which belong also the tube-worms (*Sabella*), which encase themselves in tubes of sand and fragments of shell, great colonies of these being aggregated into a rock-like structure.

Sea-Lilies, Sea-Urchins, etc. Till a comparatively recent date the sea-lilies, or crinoids (Crinoidea), were supposed to be an almost extinct group, but deep-sea dredging has revealed the existence at the present day of a large number of these beautiful organisms in the ocean depths. Crinoids consist of a long slender stem formed of a number of calcareous discs with a central axis of organic substance, which is attached by its base to the sea-bed. At the summit of the stem is a cup, or calyx, from which radiate a number of arms, also composed of calcareous joints, and surrounding the central cup. Most crinoids are fixed throughout life; but there are certain species, such as the British feather-star (*Antedon rosacea*), in which this fixed condition is only temporary, the cup and its arms becoming in the adult condition detached from the stem, so that for the rest of its life the organism is free-swimming. Among the modern fixed types of sea-lilies, it may be mentioned that the genus *Pentacrinus* is very ancient, dating from the Jurassic, or Oolitic, period of geological history. Other genera have been named *Rhizocrinus*, *Bathycrinus*, and *Hyocrinus*, and there are several others.

From the nature of the case, little can be known with regard to crinoids in the living condition. Their food consists, however, of pelagic organisms and minute crustaceans, and, as a rule, the largest supply of this nutriment is obtained by those individuals which live in deep water, as they obtain not only what they collect by themselves, but they also receive a rain of dead organisms from the upper layers. The size of crinoids accordingly depends upon the amount of their food-supply, so that the largest individuals might be expected to occur in the deepest water. But where streams of ice-cold water, as on the west coast of Greenland, or larger quantities of fresh water at a higher temperature, as on the coasts of Cuba, Guadeloupe, and Japan, flow into the ocean, they prove fatal to minute organisms, and in such situations the increased food-supply renders it possible for crinoids to flourish and attain a large size in comparatively shallow water. In some instances, indeed, the individuals of certain species attain their maximum size in situations of this nature Crinoids present all colours except blue, but the smaller stalked forms are invariably yellow.

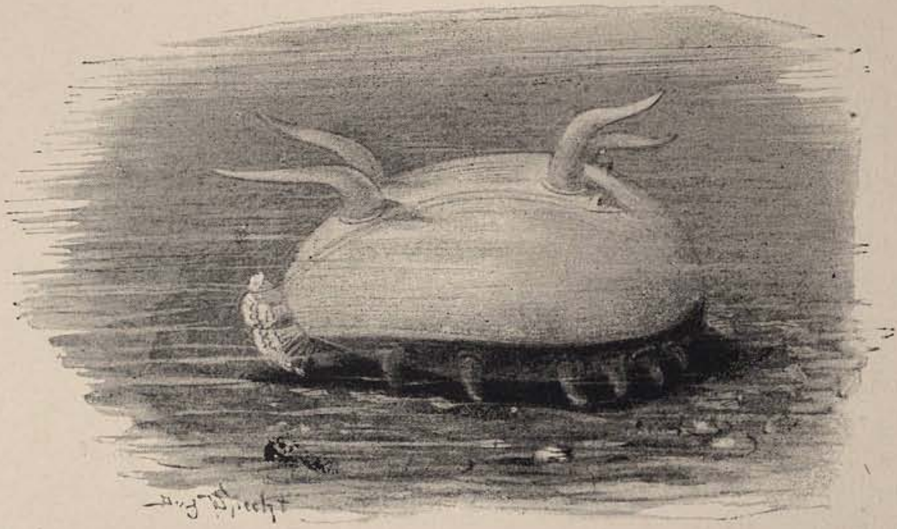
Feather-stars, and apparently also fixed crinoids, attain a great development in the Austro-Malay Archipelago, the Australian representatives of the former group being specially noticeable for their brilliant and varied colouring. The star-fishes, to which allusion has been made in an earlier chapter, belong, like sea-lilies, to the class Echinodermata, and likewise also attain great numerical development as well as extreme brilliance of colouring in the Austro-Malay region. Tropical seas are also favourable to the development of sea-urchins in the matter of size; the spines of certain species from the Great Barrier Reef of Australia measuring as much as a foot in length. In another section of the same class sea-cucumbers, or holothurians, are in the main a tropical group. These organisms, some of which furnish the trepang, or bêche-de-mer, so dear to the palate of the Chinaman, are typically cucumber-shaped or even worm-shaped, echinoderms, with soft, flabby skins, and a ring of tentacles surrounding the terminal mouth. As a well-known species, mention may be made of Hyndmann's sea-cucumber (*Cucumaria hyndmanni*) inhabiting the Mediterranean and both Atlantic coasts, at depths ranging down to 60 fathoms. The black sea-cucumber (*Holothuria atra*),



HYNDMANN'S SEA-CUCUMBER.

of the Indo-Pacific, may be cited as an example of species in which protrusile tube-feet, like those seen on the under side of a starfish lying on its back on the beach, are developed; these so-called feet in this particular species being irregularly distributed, instead of arranged in longitudinal rows, as is more generally the case. Some species entirely lack tube-feet; and in the deep-sea representatives of the group such feet are present only on the under surface of the body, the upper side being furnished with long conical papillæ, which appear to be specially modified feet no longer used for progression. In one remarkable deep-sea species known as *Scotoplanes globosa* these dorsal papillæ are reduced to four.

Corals and Sea-Anemones. Although deep-sea corals extend from the Arctic to the Antarctic Ocean, in which they may be found from depths of at least 2900 fathoms to less than a fathom, the reef-building types, which are those of the greatest general interest, are restricted to the warmer seas, more especially the Indo-Pacific. None of them can live at a depth exceeding 20 fathoms, or in water of which the temperature falls below 68° F. Corals are not tidal organisms, and must always be covered either by the water or washed by the surf, as a very short exposure to the rays of the sun is sufficient to kill the polyps. From observations made on the Cocos-Keeling Atoll and in the Solomon Islands it has been ascertained that corals are subject to great seasonal and individual variation in their rate of increase, while there is likewise a great difference in this respect between the branching and the massive groups. On the average, it appears that branching corals grow about 3·7 inches in a twelvemonth, whereas the massive species increase their diameter by about one thirty-seventh of their original circumference in a hundred days. In other words, a coral of 37 inches in diameter will measure 38 inches across in a little more than three months.



SCOTOPLANES GLOBOSA.

Of the massive forms, the most abundant types are *Porites*, star-corals or *Astræa*, madrepores or *Madreporaria*, and, in sheltered positions, brain-corals or *Meandrina*. These or nearly allied forms are to be found right through the coral-zone of the Red Sea and the Indian and Pacific Oceans; but the West Indian coral-fauna has a distinct character of its own. As a rule, the higher the minimum temperature of the sea, the more abundant and luxuriant do corals become; the richest coral-fauna in the world being that of the seas around the Fiji Islands.

Corals, together with their near relatives sea-anemones, are members of the class Anthozoa, or Actinozoa; the more typical group, which includes the reef-building species, as well as sea-anemones, constituting the suborder Zoantharia in which the polyps and their supporting cups are usually constructed on multiples of a six-rayed type, as may be verified by counting the number of vertical partitions in a mushroom-coral. Single, non-massive corals often attain very considerable dimensions, specimens of the mushroom-coral (*Fungia patella*), for example, not infrequently measuring as much as eight inches across the disc and half as much in height. Compound colonies of the massive corals, such as some of those shown in the illustration on page 367 of the great barrier-reef of Australia, grow, of course, to much larger size, an example of *Turbinaria peltata* in the British Museum measuring 16½ feet in basal circumference and weighing just over 13½ cwt.

The brilliantly coloured and delicately made sea-fans or bark-corals of the genus *Gorgonia* and its relatives, together with the sea-pens (*Pennatula*, etc.), in which the skeleton is much reduced, belong to a group, the Alcyonaria, in which the vertical divisions in the cups for the polyps are eight in number, as are also the tentacles of the polyps themselves; such tentacles, moreover, having fringed or pinnate tips, instead of the simple summits of the numerous tentacles of the reef-building corals and the sea-anemones. Many of these alcyonarians form conspicuous features of coral-reefs. To this division belong the massive blue coral (*Heliopora cœrulea*) of the Pacific, a species of particular interest as being the survivor of a type abundant during the Palæozoic epoch; the well-known red organ-pipe coral (*Tubipora musica*), in which the individual polyps live in separate tubes connected together by horizontal platforms; and the precious red coral (*Corallium rubrum*), the species to which the name coral appears properly to belong. A remarkably handsome representative of the organ-pipe corals is *Tubipora hemprichi*, of the Red Sea and Indian Ocean, in which the tubes are rich purple. Corals may in fact be of many colours, ranging from white or pure yellow to the full red-pink of the precious coral and the deep polished ebony-black of the large branching stems of the tree-like species known as *Gerardia savalia*, in which the branches interlace and unite with one another to form a network. Despite the horny nature and peculiar form of its skeleton, this splendid species should apparently be classed with the reef-building forms in the zoantharian section.

Although some mention has previously been made of the precious red coral of the Mediterranean and adjacent parts of the Atlantic, it may be well to observe that the genus *Corallium* is represented by other species in the seas of Japan, Mauritius, and Madeira. Mediterranean red coral was well known to the Romans, and about the beginning of the Christian era was exported in such large quantities to India that it was difficult to obtain in the countries where it was produced. The great bulk of the coral is sold at Messina, Naples, Genoa, Leghorn, and

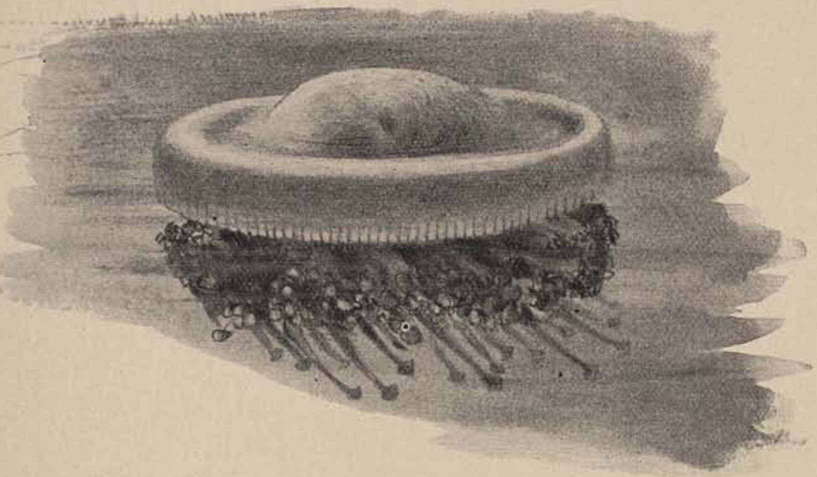
Marseilles, but the product of the Algerian fishery is sent to Pisa and Trapani. About 160 tons of coral are brought yearly into Italy, the articles made from which are valued at nearly £500,000. The total annual value of rough coral has been estimated at £2,000,000, while after manufacture the value is stated to reach £10,000,000. The finest quality is of a delicate pinkish or flesh-like colour, uniform in tint throughout, and occurring in large pieces. Inferior samples are sold at £2 per ounce, and small fragments, used for children's necklaces, at 5s. an ounce. Even worm-eaten coral has a certain value in the East, as the natives of some countries believe that gods dwell in the cups for the polyps. Of the several species of Japanese red coral, the one locally known as momoirosango, and technically as *Corallium elatius*, is the most valuable, attaining a maximum value of about £30 per pound.

Of sea-anemones it will be unnecessary to give a long notice on the present occasion, as the general characters of the more typical forms are well known, although it may be repeated that their numerous tentacles terminate in simple points. A few of the tropical species attain very large dimensions, measuring in some instances as much as a couple of feet across the disc. The more typical anemones are inhabitants of shallow water, and are attached by their large basal discs to rocks, pebbles, shells, sea-weeds, etc. Several of them, such as the British *Adamsia*, attach themselves to the shells carried by hermit-crabs; this copartnership being apparently advantageous to both animals, the crab being probably protected from some enemies by the anemone, while the latter obtains a share of the food captured by the crab. Such partnerships, it appears, are not indiscriminate, as an anemone of one species almost invariably associates with a particular kind of hermit-crab.

Certain anemones belonging to the family *Halcampidæ* depart from the ordinary type in that the base takes the form of a blunt cone, which is fixed in sand or mud. Yet another group, the *Minyadidæ* of the southern seas, has taken to a free-swimming pelagic existence; these species floating, mouth downwards, just below the surface of the water, supported by a bladder formed from the basal disc and filled with gas. One of these pelagic sea-anemones is specially characterised by the absence of the tentacles, which form such a distinctive feature of the upper disc of the other members of the group, and has accordingly been named *Anactinea pelagica*. These remarkable anemones were discovered in the tidewash of the Orissa coast of Bengal, and when first found were spherical in shape, although when placed in water they soon changed to an ovate form.

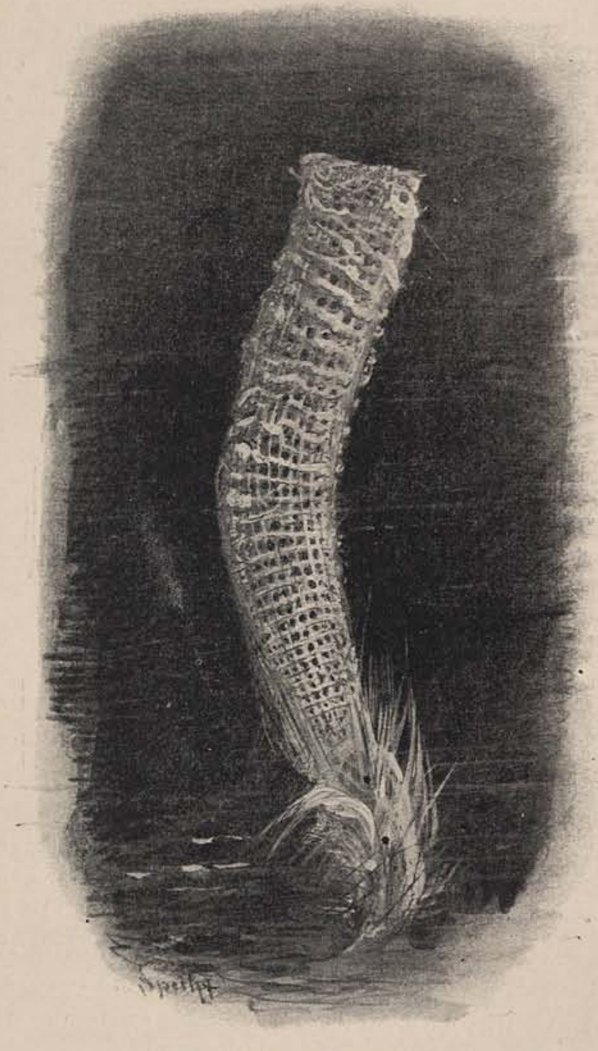
Ctenophores and Jelly-Fish. The title of Ctenophora, that is to say, comb-bearers, has been bestowed on a group of free-swimming and for the most part translucent pelagic organisms belonging to the same great group, the Cœlenterata, as the corals and sea-anemones, but constituting, with the corallines and jelly-fishes a separate subclass, the Hydrozoa, of which the little fresh-water *Hydra* is the typical representative. This designation refers to the vertical rows of comb-like structures which run in parallel lines along the muscular bands of the body; these organs being employed in locomotion, as the body does not alternately expand and contract after the fashion obtaining in the true jelly-fishes. Exceedingly beautiful in form as are these delicate organisms, they are nevertheless most voracious. The most widely distributed forms belong to the group typified by the elegant melon jelly-fish (*Beroë ornata*), so called from the oval shape of the delicate translucent body, which is greyish white or pinkish in colour, and may measure as much as six inches across. This beautiful organism is as common near the shore as in the open sea; but the allied *B. forskalia* of the Atlantic is a much rarer type, distinguished by the somewhat flattened body. When young, this species is quite transparent, but subsequently becomes rose-coloured, with a brown tinge on the narrow sides of the body. One of the most beautiful of all free-swimming oceanic forms is the so-called Venus' girdle (*Cestus veneris*), which is iridescent in sunshine and phosphorescent at night, and has the body expanded into the shape of a ribband, with the mouth placed midway on the lower edge.

With regard to the ordinary branching and graceful animals constituting the section Hydroida, it must suffice to state that these form horny, plant-like growths, in which the termination of each branch carries a polyp. All these polyps are organically connected through the medium of tissues in the interior of the branches; but they are of two totally distinct types, one of which is essentially a little elongated bag or tube, crowned with a ring of tentacles, and thus strictly comparable to the fresh-water hydra, while the other, which in many cases ultimately becomes detached and swims away to enter on a pelagic existence, is practically a jelly-fish or medusa. These medusas are bell-shaped, translucent organisms, with the mouth and digestive organs hanging from the centre of the concavity of the bell, or, as it is often called, umbrella. In the walls of this pendent mass are developed the eggs. Locomotion is effected by alternate contractions and expansions of the umbrella. A colony of these hydroids, such as that of *Bougainvillea fructicosa*, accordingly comprises one set of individuals the function of which is to procure food, and a second set the duty of which is to develop and carry eggs. The hydroid colony may directly develop eggs without giving rise to free-swimming medusas, but when the latter are produced, these fertilised eggs give rise to new stationary colonies, so that we have here a perfect



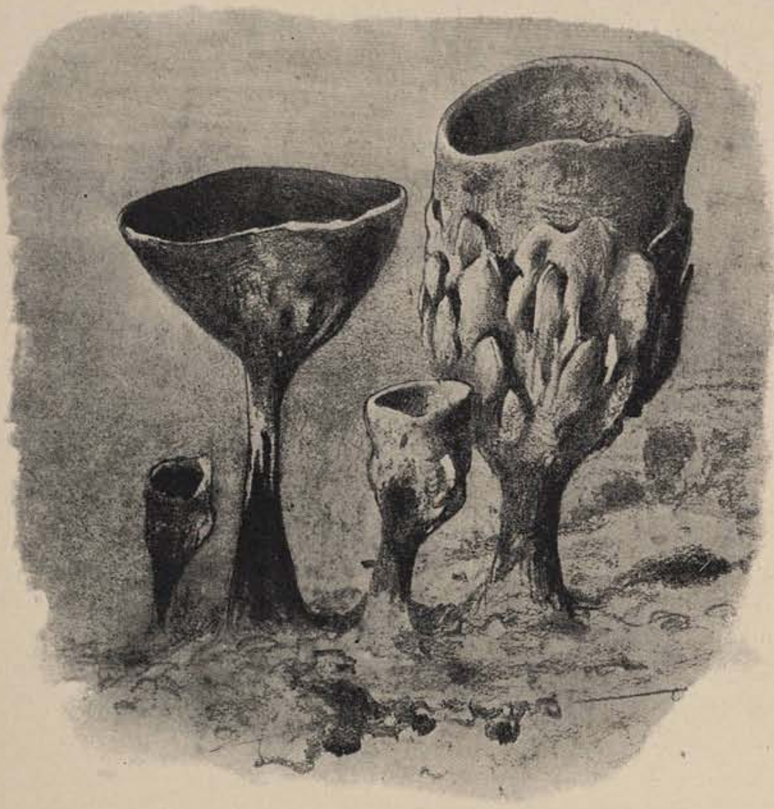
A MEDUSA.

example of the alternation of generations. The so-called corallines, or Hydrocorallina, which resemble the true corals in possessing a calcareous skeleton, display a very similar, although in some respects a more complicated type of growth and reproduction, many of them producing free-swimming medusas. The true medusas or jelly-fishes, on the other hand, constitute a group, the Medusæ, in which the eggs formed by one medusa develop in many cases directly into another, without the intervention of a stationary stage, such a fixed stage having in all probability, as in the case of the tadpole stage of certain frogs, been suppressed. In the typical group of these medusas, which constitute the ordinary jelly-fishes, or sea-nettles, such as *Aurelia* and *Cotylorhiza*, there is, however, a fixed stage. In the former of these the fertilised egg of the medusa develops into a hollow embryo, covered with fine hairs (cilia), which eventually settles down in the form of a small polyp provided with digestive organs, and carrying sixteen tentacles. During this so-called 'scyphistoma' stage the polyp undergoes transverse fission, and is divided into a number of segments, each of which resembles a saucer with a scalloped margin. These, which then constitute the 'ephyra' stage, separate and swim away; taking the form of a disc with eight bifid arms. To make a long story short, the spaces between these arms are filled up, certain other changes take place, and the 'ephyra' eventually becomes a fully developed medusa of the *Aurelia* or *Cotylorhiza* type.



VENUS' FLOWER-BASKET.

Sponges. With the exception of a number of fresh-water types, the great group of sponges constituting the group Porifera—of equal value with the Cœlenterata—are marine organisms of low grade, which are to be found at all depths; the deep-sea types being those with calcareous or wholly flinty skeletons in place of horny ones. Of those with flinty skeletons the most graceful is the well-known Venus' flower-basket (*Euplectella aspergillum*), inhabiting the seas around the Philippines at a depth of from 60 to 100 fathoms. The beauty of the vase-like, interlaced, white, flinty skeleton, which grows to a length of about a foot, is known to most persons. A second species, *E. oweni*, from the seas of Japan, differs by the vase being straight instead of gracefully curved. Very curious, too, are the beautiful glass-rope sponges of the genus *Hyalonema*, which are typically Japanese, although also widely distributed in the southern oceans. Intermediate between the glassy and the horny groups is the mermaid's glove (*Chalina ocellata*), which has a fibrous as well as a flinty skeleton, and is from time to time washed ashore on the English coasts. A striking species in the horny group is the great Neptune's cup (*Poterium neptuni*), which resembles a vase in shape, and may stand as much as a yard in height. The typical representatives of the horny group are, however, the various species used for domestic purposes, such as the ordinary bath-sponge, *Spongia officinalis*, the Turkey sponge, *S. o. mollissima*, and the coarser type known as the horse or bath sponge, *Hippospongia equina*. All these are natives of the warmer seas to the north of the equator, but a number of kinds of sponges from the southern seas are gradually coming into use for domestic and other purposes.



NEPTUNE'S CUP SPONGE.

From among a host of other types, reference may be made to *Murrayona phanolepis*, an interesting type of sponge from Christmas Island, in the Indian

Ocean, referable to the family *Pharetronidæ*. When this family was first established, it was believed to be extinct, with its latest representative, in the Maestricht Chalk of Belgium; but, inclusive of the Christmas Island species, which constitutes a subfamily by itself, six living genera, each with a single species, are now known. *Murrayona* differs from the other genera in that the skeleton consists of a firm skeletal network devoid of spicules, and overlain by a superficial layer of scales, the axial core of spicules found in the other living genera having been discarded. The absence of spicules in some of the fossil *Pharetronidæ* may be due to the same cause, although in other instances it may be the result of fossilisation.

In conclusion, reference may be made to certain curious masses dredged a few years ago in the Bay of Bengal, which proved to be sponges associated with gregarious molluscs of the gastropod family *Vermetidæ*, the latter being embedded in the former. The masses are of two types, one consisting of shells with serrated ridges embedded in moderately hard black sponges, and the other of smoother shells associated with stony sponges, varying in colour from red to yellow. The ridged shell is *Siliquaria muricata*, and the associated sponge *Spongoscites topsenti*. The second type comprises two molluscs, *Spiroglyphus cummingi* and *Siliquaria cochlearis*, the associated sponges being two forms of the species known as *Racodiscula sceptrellifera*, which differ from one another in colour. When fresh, the masses of the second type must have had a brilliant appearance, the sponge being red or orange, the shells pink, and the soft-parts of the molluscs yellow. Both the two sponges associated with the three *Vermetidæ* are found elsewhere growing alone.

Sponges form the lowest group but one in the whole animal kingdom; the lowest of all being the Protozoa, or single-celled organisms, such as the so-called animalcules. In such an enormous group mention of any particular genera or species is out of the question on this occasion.

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